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Tidal Power Study, Cobscook Bay, Maine, USA

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PLAN OF STUDY

FOR THE

TIDAL POWER STUDY

COBSCOOK BAY, MAINE, USA

PREFACE

Plan of Study

for

Investigation of Tidal Power

Cobscook Bay, Maine, U.S.A.

PREFACE

For centuries man has devised methods of putting the ocean tides to work. As early as the eleventh century tides were harnessed in a small way in England and other Western European countries when small tide mills were used to grind corn. Since the advent of hydroelectric power, numerous tidal power sites throughout the world have been investigated. One of the principal tidal areas to be investigated is the Cobscook Bay region in Maine. Tidal hydroelectric power, similar to river hydropower, can be produced by a flow of water from a higher to a lower level through hydraulic turbines. It is anticipated that the final tidal power report resulting from the Plan of Study will be an acceptable tidal hydroelectric power project which will conserve natural resources and provide much needed non-polluting electrical power.

The Plan of Study (POS) presents the general procedures to be followed in determining the need, advisability, plan formulation and determining impacts and recommendations of a tidal power project in the Cobscook Bay region of the State of Maine. The purpose of the project is to generate electricity from tidal action for consumption and benefit in the State of Maine and New England region.

Briefly, this document includes tasks to be accomplished, assignments and responsibility of such tasks, study scheduling, allocation of study costs, and coordination required for the planning of three (3) items namely:

a. The Tidal Power Project Report

b. The Transmission Lines

c. An Environmental Impacts Statement for the Transmission Lines and Tidal Power Project

The plan specifies that in investigation the solutions to aid in alleviating the region of possible power shortages in the future, higher energy costs, and dependency on exterior energy sources, that consideration will be given to the objectives of National Economic Development, Regional Development, Environmental Quality and Social Well Being. All significant adverse and beneficial project effects on the economic, social, environment, aesthetics of the area, and safety aspects will be identified and assessed. The eliminating or minimizing the adverse effects will be fully explored so as to arrive at the most "Cost-effective" and acceptable project possible.

In addition to electric power which is the main purpose and the primary benefit of the project, ancillary benefits such as area redevelopment, fisheries-mariculture and recreation will also be investigated.

The tidal power study will incorporate and update information from previous tidal power investigations in the area wherever possible.

The study will result in a Survey Scope Report referred to by the U. S. Water Resources Council as type Level C for implementation level studies.

The Plan of Study is considered a flexible planning tool which will, by reason of continued coordination, communication, and findings, be subject to change as required and as the study progresses.

The Plan of Study has been jointly prepared by the Corps of Engineers and interested agencies. The resultant Survey Scope Study and Report is scheduled to be accomplished at an estimated cost of $3,280,000 over an approximate four-year period.

The preparation of the Plan of Study and The Survey Scope Report will be accomplished with benefit of a coordinated Public Involvement Program to assure that the public expression is incorporated into the project.

The Plan of Study does not constitute a report on the tidal power project, nor is the tidal power project authorized for advanced engineering and design or construction at this time. However, the Plan of Study does include a Reconnaissance Report (Section III) which provides preliminary information on the study area, description of some tidal power alternatives, and various concerns to be addressed in the proposed Survey Report.

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SECTION I

THE STUDY INTRODUCTION

PLAN OF STUDY

INVESTIGATION OF TIDAL POWER

AT

COBSCOOK BAY, MAINE

SECTION I

THE STUDY INTRODUCTION

SECTION I

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G. Discussion on Assumptions and Criteria

a. Discount Rate

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PLAN OF STUDY

INVESTIGATION OF TIDAL POWER
AT
COBSCOOK BAY, MAINE

I. THE STUDY INTRODUCTION

A. General

The New England Division, Corps of Engineers has been authorized to re-evaluate and accomplish an up-to-date Survey Investigation Study of tidal power potential in Cobscook Bay, Maine to determine its economic feasibility under present conditions, investigate environmental concerns and explore various alternatives for the purpose of recommending authorization of a specific plan, to assist in solving future electrical power needs of the State of Maine and New England region.

The study has been classified and officially titled as a Special Study, Passamaquoddy Tidal Power, Maine (CWIS 14023), as it presents a water resource potential that does not fit into any type of regular basin planning study. A Special Study such as this often involves a fairly large geographical area which makes up the study complex and which does not fit the category of a comprehensive river basin study. In addition to providing tidal power, interests in recreation, economic development, and related land and water resources will also be investigated.

B. Background

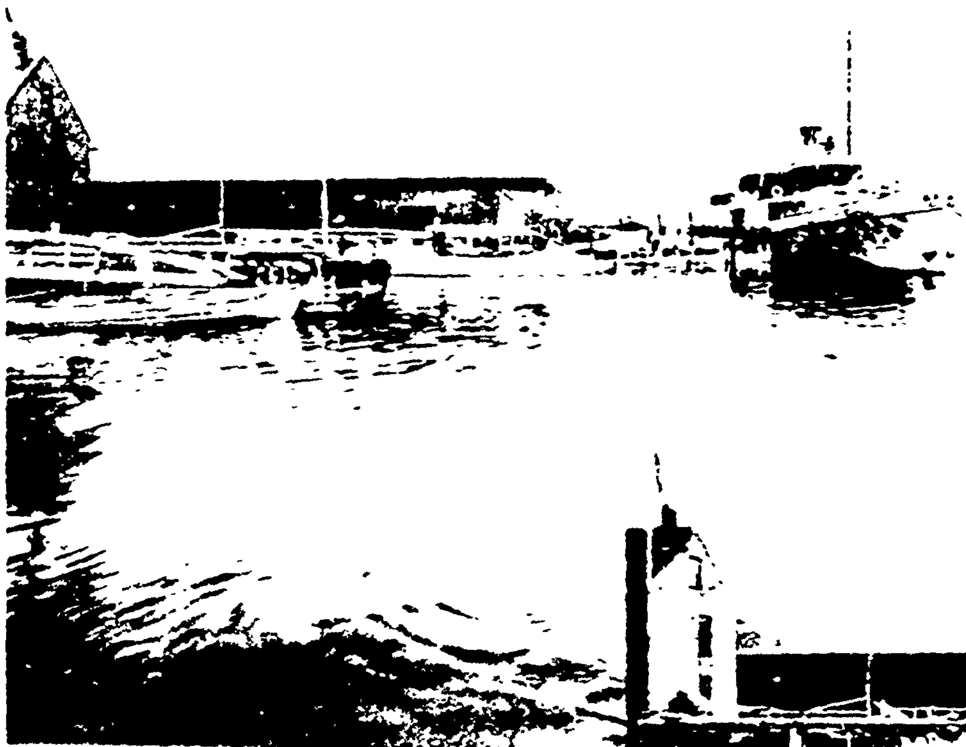
The project site is located in Cobscook Bay, Maine. The project is founded on harnessing the power resulting from high tidal range

(averaging 18 feet) in the vicinity of Cobscook Bay. The developed electric power would be supplied to the State of Maine and the New England region of the United States. Figure 1 illustrates the high and low tidal difference in the study region.

Over the past 50-60 years, tidal power projects in the vicinity of Cobscook and Passamaquoddy Bays have been studied many times and varying construction and operational concepts have been proposed. In 1935, construction of a single pool plan entirely within the United States utilizing Cobscook Bay as the high pool was commenced by the Corps of Engineers for the United States. Two dams and some housing and support facilities were completed before work was stopped in 1936 due to lack of funds. The tidal projects to be evaluated under this new study involve single and double pool concepts with many various configurations.

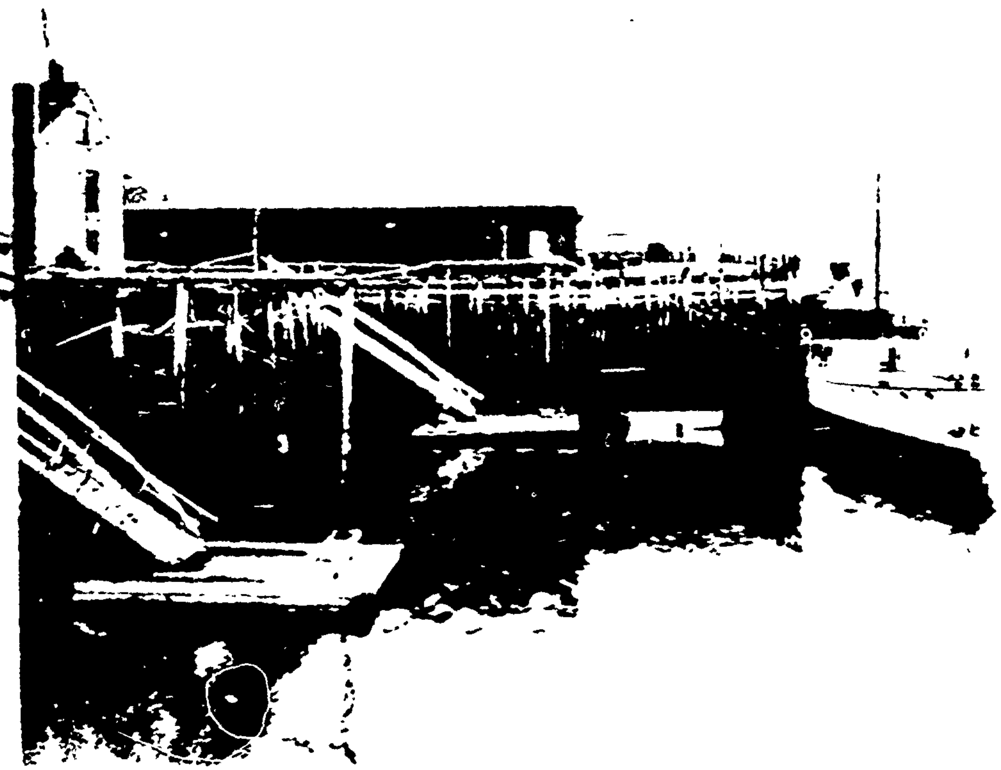
The last tidal power study in the area was accomplished by the International Passamaquoddy Engineering Board in October 1959 with subsequent revisions and recommendations by the International Joint Commission, Department of the Interior and the Congress. The international tidal project envisioned in 1959 utilized both Passamaquoddy and Cobscook Bays and included an auxiliary river hydro power project at Rankin Rapids, Maine. The latter project was subsequently separated from the tidal project and relocated to the Dickey-Lincoln School project site to be authorized as its benefit/cost ratio was above unity. The tidal power project was set aside to be re-examined and study be continued because its benefit/cost ratio was less than unity.

In April 1977, the New England Division completed a preliminary analysis of updated construction, operations and maintenance costs, as



HIGH TIDE

In the vicinity of Eastport, located on Moose Island, between Passamaquoddy and Cobscook Bays, mean tide year in and year out averages 18 feet.



LOW TIDE

The most significant feature of "Quoddy" region is that Passamaquoddy and Cobscook Bays, open on, and are part of, The Bay of Fundy where occur the highest tides in the world

FIGURE NO. 1

well as anticipated annual benefits which could be derived from electric power, area redevelopment, recreation and fisheries-mariculture. This study considered both International and all United States plans. Based on the results of this economic study, it was determined that a tidal power project appeared to be economically feasible when evaluated by the "life-cycle costing" methods, but not feasible when evaluated by the conventional annual "benefit/cost ratio (BCR)" method as dictated by the United States Congress for evaluating Water Resource Projects. Prior to the recent preliminary economic feasibility stage of planning, it was decided that the economic feasibility of the project from the United States viewpoint should first be determined before contacts, coordination and study participation were requested of the Canadian officials.

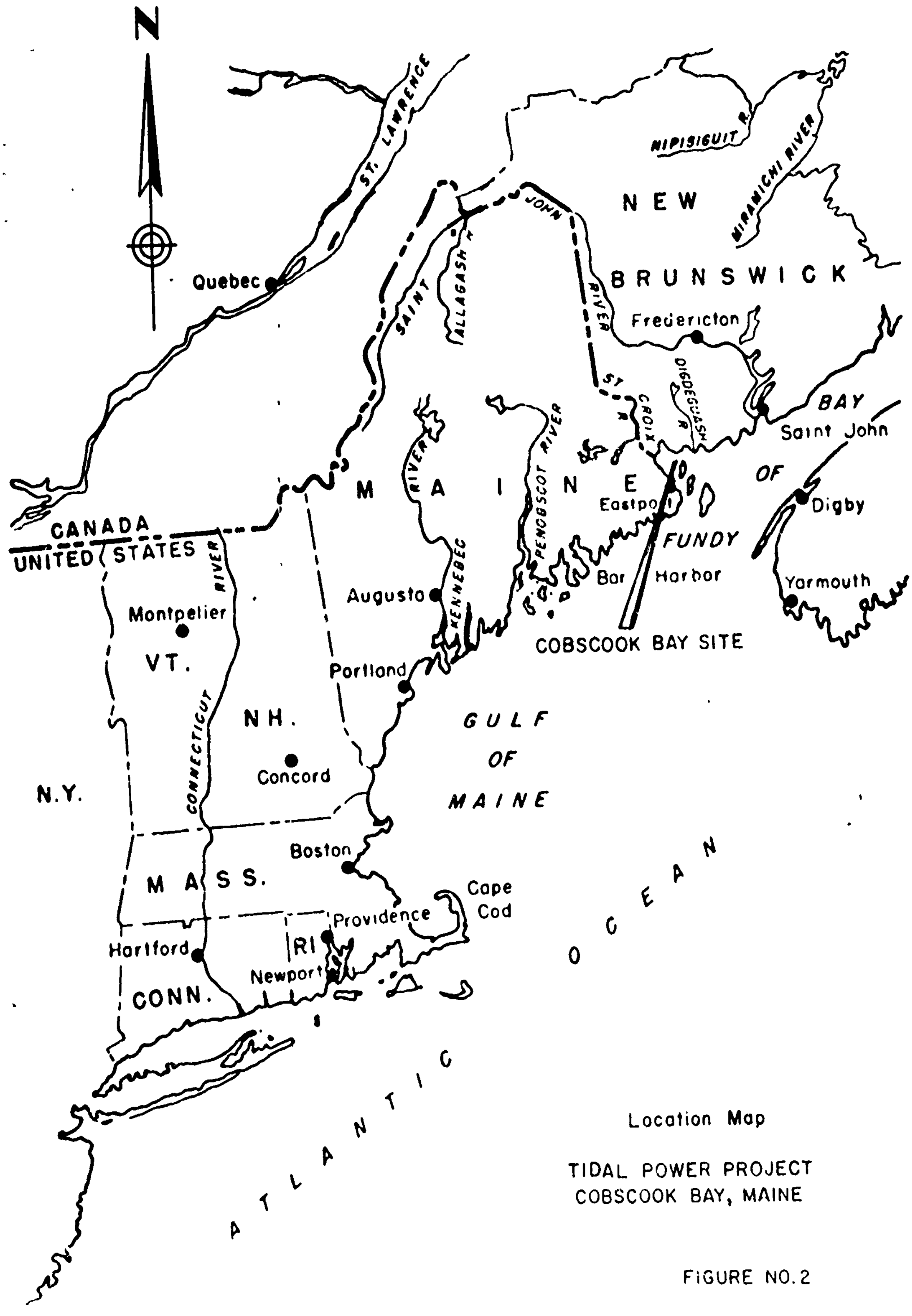
Following the completion of an economic analysis the Canadian Government was contacted. On 10 May 1978, the Canadian Government formally indicated that it did not want to participate in a joint Study in the Passamaquoddy Bay region. Therefore, International projects will not be considered in this survey investigation, at least not at this time.

Figure 2 shows the general location of the Cobscook Bay Region in the northeasterly portion of the United States, and Figure 3 is a vicinity map showing both Cobscook Bay and adjacent Passamaquoddy Bay.

C. Authority and Justification

The authority for this work is derived from:

- Resolution adopted on 21 March 1975 by the Committee on Public Works, United States Senate, as sponsored by Edmund Muskie, Senator from Maine. (See Attachment No. 1)



Location Map

TIDAL POWER PROJECT
COBSCOOK BAY, MAINE

FIGURE NO. 2

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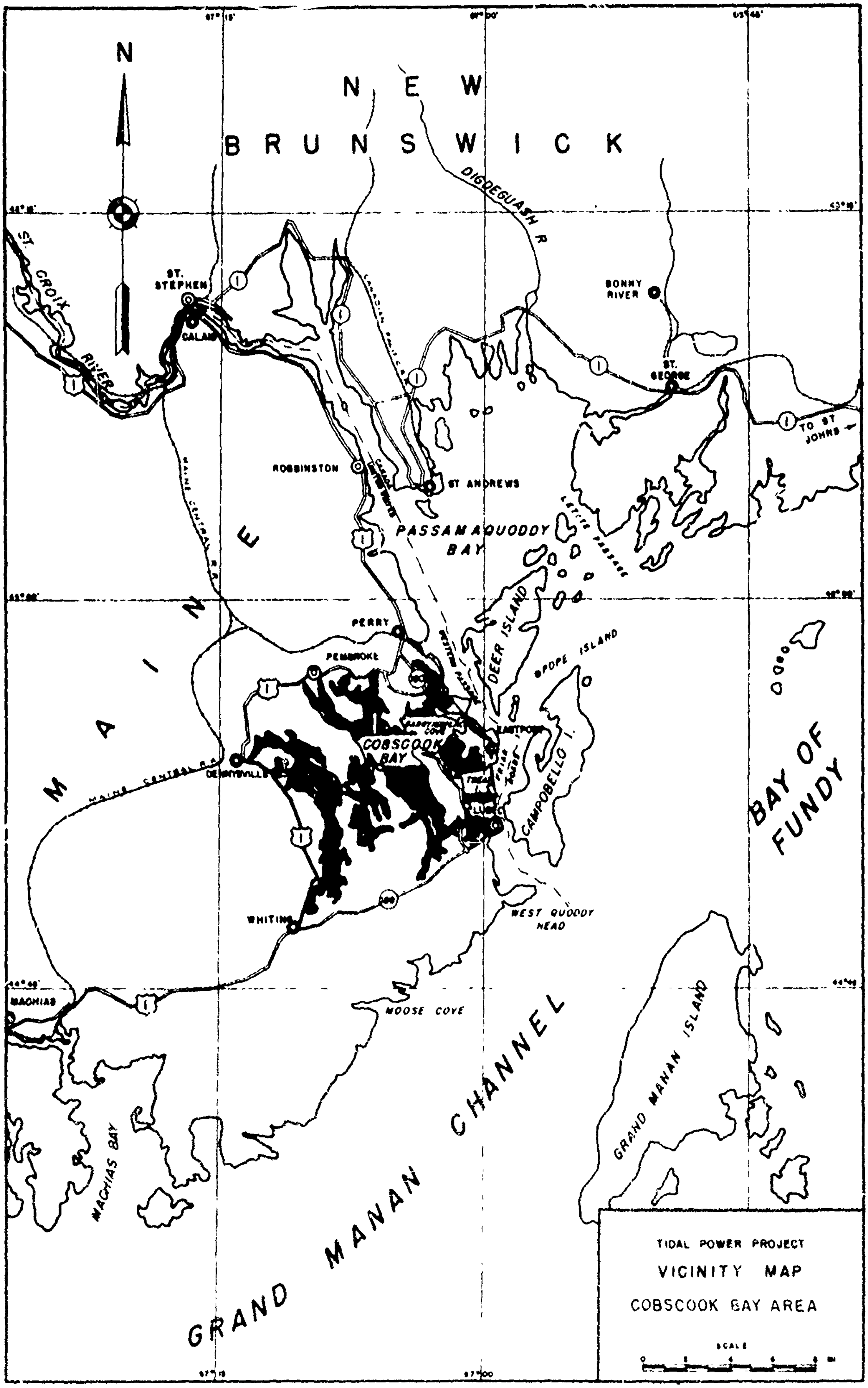

N
NEW BRUNSWICK
DIGDEGUASH R
ST. CROIX RIVER
ST. STEPHEN
CALAIS
BONNY RIVER
ST. GEORGE
TO ST JOHNS
ROBBINSTON
ST ANDREWS
PASSAMAQUODDY BAY
LETITE PASSAGE
MAINE
MAINE CENTRAL R.R.
PERRY
PEMBROKE
DEER ISLAND
POPE ISLAND
COBSCOOK BAY
EASTPORT
FRIAR ROADS
CAMPOBELLO I.
DENNYSVILLE
BAY OF FUNDY
WHITING
WEST QUODDY HEAD
MACHIAS
MOOSE COVE
GRAND MANAN CHANNEL
GRAND MANAN ISLAND
MACHIAS BAY
TIDAL POWER PROJECT
VICINITY MAP
COBSCOOK BAY AREA
SCALE

FIGURE NO 3

* Public Law 94-180, Public Works Appropriations Act for Fiscal Year 1976 approved on 26 December 1975.

* 1st Endorsement. Letter from Office, Chief of Engineers, Subject: "Passamaquoddy Tidal Power Project (CWIS 14023, dated 28 September 1977)," which authorized the New England Division Corps of Engineers to prepare a Plan of Study for the Tidal Power Project.

Prior to initiating the preparation of the Plan of Study, the Corps of Engineers, New England Division, accomplished a preliminary Economic Feasibility Study of the tidal power projects to determine if the projects were economically feasible under present conditions and if further study on the projects was warranted. The results of this economic study are included in the "Reconnaissance Report" Section of this Plan of Study. In a report published by the New England Division, 29 April 1977, it was determined that both the All United States and International plans were not economically feasible when evaluated by the conventional methods dictated by Congress for analyzing water resource projects. When the projects were evaluated on a "life-cycle" costing method, the projects were considered economically feasible. Presently, however, this method is not an authorized procedure.

This Division was authorized to prepare a Plan of Study for Tidal Power and to further investigate and utilize "life-cycle costing" as the possible economic basis for the project study by a letter file dated 28 September 1977 from the Office, Chief of Engineers.

D. Purpose and Objectives

1. Purpose

The purpose of the Survey Scope Study is to investigate and evaluate a tidal power project.

plan which would produce electrical power and benefit the inhabitants of the State of Maine and the New England States.

2. Goals and Objectives

In general, the goals and objectives of the study are varied and long term in nature. They are basically established in the interest of increasing electric power supply, maintaining environmental quality, conservation of natural resources utilizing a natural resource phenomena in the area and enhancement of economic-social aspects in the study region. Further, to reduce state, regional and national dependence on foreign fuel supplies for the purpose of generating electric power.

The public will have a significant opportunity to express their views concerning its objectives through an open planning and public involvement process designed for the study.

The following planning objectives of the study from a Federal and regional point of view are provided:

a. National Objectives

The planning objectives of the study are in tune with the national objectives related to water and energy resources. In accordance with basic policies of multi-objective planning expressed in ER 1105-2-200, Federally assisted water and related land planning must be directed to achieve National Economic Development (NED) and Environmental Quality (EQ). The NED objective is to enhance national economic development by increasing the value of the Nation's output of goods and services and by improving national economic efficiency.

The EQ objective is to enhance the quality of the environment by the management, conservation, preservation, creation,

restoration, or improvement of the quality of certain natural and cultural resources and ecological systems.

b. National Accounts

In addition to the objectives, planning activities must address certain national accounts which measure significant impacts of any given alternative: National Economic Development (NED), Environmental Quality (EQ), Social Well-Being (SWB), and Regional Development (RD). Beneficial and adverse effects of the NED account are measured in monetary terms such as the power benefits and construction costs. The effects of the EQ account are usually measured in non-monetary terms such as higher quality or loss of wildlife habitat. Intangible effects on health, safety and community well-being are considered in the SWB account. Broad economic impacts affecting a region such as regional income and employment contributions are the subject of the RD account.

c. Related National Policies

Among national policies as expressed in the Water Resources Act of 1976 (Public Law 94-587, 90 State 2935) and the President's national energy program address of 20 April 1977 are:

- To provide, in the complete sense, for future national energy requirements.
- To maintain the security and policy independence of the nation by the reduction in dependence on foreign fuels.
- To encourage national energy conservation.
- To promote equitable solutions to energy problems for various regions, classes and interest groups.

d. The Study Objectives

The planning objectives were established by analyzing the specific needs of the study area in terms of the national and regional objectives. Each objective was related to the specific national account (National Economic Development, Environmental Quality, Regional Development and Social Well-Being) addressed.

These planning objectives will be reviewed and classified during the course of the investigation.

The tidal power project is considered to increase the energy self-sufficiency of the State of Maine and New England region and, therefore, relates to the National Economic Development and Regional Development Accounts. In addition, the project lends to making maximum use of energy potential afforded by the region's natural water resources and increases National Economic Development.

e. New England Federal Regional Council's Objectives

Considerations which are noteworthy and possess merit are that natural energy resources would be conserved, and by the nature of the tidal power project, meet the New England Federal Regional Council's objectives:

- Reduce the region's high dependence on petroleum to produce electrical power and its attendant high costs.
- Reduce the region's adverse weighted average energy cost differential versus the balance of the United States.
- Improve both New England's energy posture and industrial investment climate.

f. State of Maine Objectives

- To conserve energy through the reduction or elimination of processes that waste energy. Energy Conservation can be an important reduction in demand which will benefit the State economically, and help "buy time" until other resources can be developed.

- To encourage the development of native, renewable resources. The State should promote wood, solar, wind, tidal, hydro, and other native resources even though these may presently have an economic disadvantage.

- To insure an adequate supply of energy to the people of the State. Working within the framework of Federal Policy, a system should be developed and maintained to assure the proper and equitable allocation and distribution of available energy resources.

- To diversify the energy supply base in the State and promote a more equitable distribution of energy resources. Maine should reduce its dependence on petroleum as a major energy supply, replacing it with more abundant conventional and renewable sources. Greater diversification of the types of energy supply and the distribution system within Maine should also be encouraged.

E. Use of the Survey Scope Report

The findings and conclusions of the resultant Survey Scope Report (Level C) (General Investigation and Feasibility Type effort) will form the basis for either:

Recommending to Congress the authorization of the Phase I design memorandum stage of advanced engineering and design as a continuation of the survey investigation. Thence, ultimately if the findings of the Phase I design memorandum indicate a favorable project, recommending Congressional approval and authorization for the implementation of the selected tidal power project; or,

Furnishing Congress a finding that no Federal (Corps) participation in the tidal power plan in the region is warranted at this time, based on the partial accomplishing of a Survey Investigation.

F. Study Constraints, Controls and Guidelines

The tidal power study will be carried out within certain constraints and guidelines.

1. Study Constraints

a. Funding

The amount of $3,280,000 has been recommended as the funds necessary to accomplish the preparation of the tidal power study, transmission facilities and the associated Environmental Impact Statement. These funds are not sufficient to provide final type plans or specifications of a project or the ultimate in impact investigations. Varying amounts of funds will be provided during the fiscal years in which the study is conducted. The total amount of study funds will not be made available at the commencement of the study and, therefore, phasing of the work in proper sequence will be necessary. The study will be totally Federally funded through the Corps of Engineers. This phase of the study will be accomplished without benefit of a physical model of the project site.

b. Staffing

Staffing of personnel to conduct the study may cause some constraints due to existing workloads in the agencies. The publics are often limited in the time they can provide to act as observers and advisors, or to provide verbal or written input to the study.

Every effort shall be made by the Corps of Engineers to provide personnel and facilities to carry out the study to a successful conclusion as is deemed possible within available resources.

The overall study shall be conducted under the direction of the Division Engineer, U.S. Army Engineer Division, New England, Waltham, Massachusetts, 02154.

c. Physical Hydraulic Model and Geological Borings

These will not be undertaken as part of the survey study. When available, a boring data in the previous tidal studies in the area will be utilized for the study purposes. (See following Para. 3)

2. Controls and Guidelines

Various administrative controls and proceedings of the Corps of Engineers for Water Resources and Land Related Projects will be followed in the accomplishment of the study.

The Study Management Team shall carry out the study within the framework of the following prime guidelines noted under the following paragraph.

In carrying out the study, the following partial list of Federal criteria and guidelines will be adhered to:

- Water Resources Council "Principles and Standards for Planning Water and Related Land Resources," (38 FR pp. 24778-24684) dated 10 September 1973.
- Section 103 of Water Resources Planning Act (pp. 89-80)
- Senate Document 14097, May 29, 1962
- PL 92-500, Federal Water Pollution Control Act Amendments of 1972
- PL 92-583, Coastal Zone Management Act of 1972
- PL 93-205, Endangered Species Act of 1973

- PL 93-251, Water Resources Development Act of 1974
- PL 93-291, Preservation of Historical and Archeological Data
- PL 94-587, Water Resources Development Act of 1976
- PL 91-190, National Environmental Policy Act of 1969
- Senate Resolution 148
- Various Corps of Engineers engineering manuals, regulations and pamphlets.
- Federal Register, Part IV, 29 June 1977, Federal Energy Administration, "Energy Audit Procedures."
- Resolution sponsored by Honorable Senator Edmund S. Muskie, dated 21 March 1975.

It is the desire of the Study Team to also carry out the project in coordination with the various requirements of the State of Maine so as to assure compliance and consistency to the maximum in planning of the tidal power project.

3. Discussion on Assumptions and Criteria

The following assumptions and criteria will be utilized in the study, however, they may be subject to change during the course of the study to reflect revisions in guidelines and regulations.

a. Discount Rate

The formulation and evaluation of plans shall be based on the Fiscal Year 1979 Federal Discount Rate of 6-5/8%.

b. Physical Hydraulic Model for Cobscook Bay

At the outset of this study, the study cost allocation does not include provisions for a physical hydraulic model of the project area, Cobscook Bay. Presently, the study through Stage II, Development of Intermediate Plans, will be based on general estimates of future environmental conditions made from existing knowledge augmented by literature review. Upon completion of Stage II, or earlier if the indications of the economic feasibility of the project appear positive, initiation of action to provide a physical hydraulic model will be made so as to assure an appropriate detailed water quality engineering evaluation of the project area. It also appears that a physical model of the bay hydrodynamics is a future must to establish a basis from which to develop a predictive mathematical water quality model. It is considered that a physical hydraulic model will be essential to provide an accurate prediction of post-construction water quality conditions required for the Environmental Impact Statement that will accompany the Survey Scope Report on the tidal power project.

Based on preliminary information a hydraulic model investigation for Cobscook Bay would cost approximately $900,000 and take about 1 1/2 to 2 1/2 years to construct. In addition, approximately one year of operation of the model will be required to obtain necessary information for designing the mathematical model. After completion of the working mathematical model it is anticipated that an additional 1-2 years of analysis using the model would be required to predict future water quality under simulated post-project operation conditions, therefore, the apparent minimum time required to complete an environmental assessment of the tidal power project would be approximately 4 years after receipt of authorization and funds to construct a physical model.

Present schedule indicates that Stage II will not be completed until October 1979. If request for a physical model is then initiated, a full water quality evaluation of the project would not be available until at least October 1983. This would necessitate a considerable extension of the study completion date of December 1981 as shown on Plate No. 14, the Study Schedule.

At current price levels a prliminary cost estimate for a physical model of Cobscook Bay is as follows:

ESTIMATE FOR COBSCOOK BAY MODEL STUDY

Model Shelter	$140,000
Model Construction	110,000
Sump	40,000
Pumps	16,000
Lixator	25,000
Prototype Survey	40,000
Install and Maintain Tide Records . . .	15,000
Calibration Structure	50,000
Verification of Model	150,000
Dye Test	30,000
Testing (one year)	180,000
Numerical Model	75,000
	$871,000
SAY:	$900,000

NOTES:

1. Model Distortion is estimated at 5 (horizontal scale would be 5 times the vertical scale).

2. If an international tidal power plan is studied to include Passamaquoddy Bay, the project area would increase and could increase model costs.

3. Work Item 7.39 includes formulating and developing data for providing a physical hydraulic model of Cobscook Bay.

c. <u>Deep and Shallow Water Drilling Operations</u>

The water depths in Cobscook Bay, where project structures could be located, vary up to 150 feet. There is some valuable foundations and material data available from the original tidal power project for which construction was started in 1935 but stopped in 1936 due to lack of funds. However, there is not much data for all of the alternate project layouts which are possible in Cobscook Bay and entirely within the United States.

It is planned to conduct seismic refraction/reflection investigations in locations of proposed structures and dams where no data is presently available. In addition, due to funding it is proposed to develop a limited boring program in locations of least confidence along the seismic runs to validate the subaqueous and subsurface seismic data.

In the event the International Power Plans are re-evaluated with the Canadians it is considered that the deep and shallow water drilling and land drilling operations accomplished during the 1956-1959 engineering studies are adequate, except for minor types of effort, for reuse in this current study. If the study is expanded to include an international tidal power plan the cost allocations will be increased to reflect the additional cost for the minor geological foundation, and materials investigations.

SECTION II

ORGANIZATION AND MANAGEMENT

SECTION II

ORGANIZATION

AND

MANAGEMENT

SECTION II

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II. ORGANIZATION AND MANAGEMENT

A. The Planning Process

1. General

This study will be carried out utilizing the planning process described in Army Regulations ER-1105-2-200 thru ER-1105-2-250. This multi-objective planning framework provides for a complete and orderly approach to planning.

2. Description of the Planning Process

a. The planning process consists of three stages:

Stage I - Plan of Study or Reconnaissance Report - this stage stresses problem identification and study organization.

Stage II - Development of Intermediate Plans - this stage stresses the development of alternative solutions to the problems and identifying impacts associated with each alternative plan.

Stage III - Development of Detailed Plans and Plan Selection - this stage stresses the assessment of impacts and evaluates the alternatives.

b. The planning process utilizes four functional planning tasks at each stage:

Task 1 - Problem Identification
Task 2 - Formulation of Alternatives
Task 3 - Impact Assessment
Task 4 - Evaluation

c. Figure 4, shown on page graphically illustrates the Planning Process.

d. Section IV of the Plan of Study contains additional information on the Planning Process.

B. Development of Plan of Study (POS)

1. General

In developing a Plan of Study numerous tasks have to be addressed. As much data as possible must be presented to give proper direction to the overall stu However, the POS must not

be unduly overloaded with information. It should be brief and concise where possible.

The POS is prepared before many items of the study are accomplished and problems or obstacles have surfaced. It is intended to be a flexible guide that can be altered with necessary approvals, at any time during the course of the overall study to assure a successful and usable report.

2. Purpose of the Plan of Study (POS)

The Plan of Study is intended to provide a document which will allow for the orderly and timely accomplishment of the Survey Scope of Study and report on the tidal power project. The POS includes:

- a description of the project and the study area,
- a list of the items to be studied
- how the study will be accomplished
- assignment of study tasks and responsibilities,
- a schedule of study events,
- allocation of monetary resources to accomplish the study,
- study management and control
- coordination activities, and
- the report's use

3. Plan of Study (POS) Format

The Plan of Study, Stage I of three Planning stages, is comprised of five sections as follows:

SECTION	TITLE
I	The Study Introduction
II	Organization and Management
III	Reconnaissance Report
IV	Study Effort Allocation
V	Public Involvement and Coordination

ER 1105-2-200

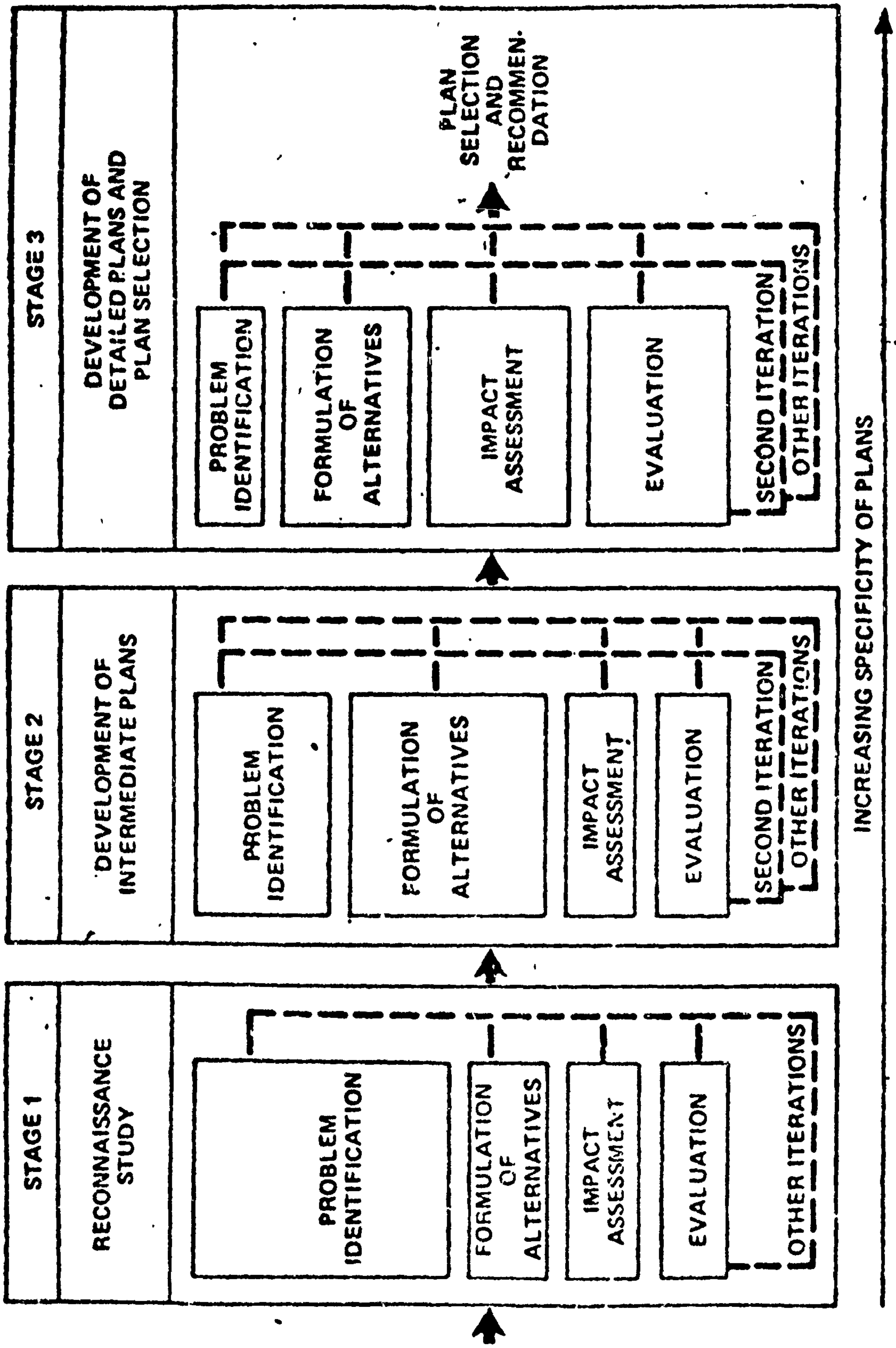

FIGURE 1: GENERAL RELATIONSHIP OF PLAN DEVELOPMENT STAGES AND FUNCTIONAL PLANNING TASKS

FIGURE NO. 4

a. Section I, Introduction

Introduces the study; cites the congressional authorities which sponsored the study, defines the purpose and objectives of the study and describes its various components and the way in which the study reports will be utilized. Also included is information regarding study constraints and controls and guidelines.

b. Section II, Organization and Management

Briefly describes the main sections of the Plan of Study document; discusses the study management, responsibility, funding, and coordination; describes the study management team and other participants in the study.

c. Section III, Reconnaissance Report

Describes the project and study area, indicates concerns and problems and needs, lists and summarized previous project reports and other on-going studies in the area, describes some of the known alternatives at this time, presents preliminary economic-environmental concerns and lists prior and on-going studies in the area.

d. Section IV, Study Effort Allocation

Outlines the sequence of the study, planning process, major work items to be accomplished. Open planning, study scheduling, assignments and tasks, study costs and report preparations are discussed here. The major work items involved and for which reports will be prepared are:

Tidal Power Project

Transmission Line Project

Environmental Impact Statement for the Tidal Power Project and the Transmission Line Facilities

e. Section V, Públic Involvement and Coordination

Outlines the public involvement and coordination activities which took place during preparation of the Plan of Study. The study management team has incorporated the public's input into the final POS to ensure a more successful study.

C. Tidal Power Project Study Management

1. General

The study will be conducted under the direction of the Division Engineer, New England Division, Corps of Engineers, Waltham, Massachusetts. At the completion of the study, it will be the responsibility of the Division Engineer to forward the report to the proper authorities and recommend whether or not that further project engineering design and/or implementation be accomplished.

The overall study will be managed by the Study Manager, under the supervision of the Chief, Planning Division, New England Division. The Study Manager and staff will be located in the Division Offices, Waltham, Massachusetts.

2. Study Responsibility

The accomplishment of the study and preparation and submission of the project report and Environmental Impact Statement is the responsibility of the Corps of Engineers. The Study Management Team will be responsible for accomplishment of the following items:

- Initiate and Carry Out Public Participation Program
- Maintain Overall Program Management Procedures
- Assign the Study Tasks
- Maintain Study Schedule
- Maintain Study Cost Data
- Maintain Working Contacts and Relationships with Agencies
- Negotiate and Monitor Contracts with Private Consultants and Work Orders with Special Agencies
- Perform technical reviews of consultant input and process payments to consultants
- Prepare Statistical Management Reports and Public Informational Data
- Maintain Mailing Lists for Distribution of Project Data to the Public
- Preparation of the Study Reports and Environmental Impacts Statement

3. Funding of the Study

The funding for the All U.S. tidal power study including investigation for transmission lines and Environmental Impacts Statement will be a totally Federal funded effort. The Federally appropri-

ated funds will be furnished by the Congress to the Corps of Engineers for carrying out the study. A subsequent Section in this Plan of Study provides information on funding and study costs. The conductance of the study will be dependent on the availability and funding provided by the U.S. Congress on a Fiscal Year basis. (The U.S. Fiscal Year is 1 October through 30 September of each year.)

4. Study Coordination

The study will be coordinated with all interested Federal, State, Regioal, Local and other agencies and groups by the Corps of Engineers through the Study Manager. Liaison and coordination will be maintained during all phases of the study period and afford comment and input through an open planning program. Coordination with Canada on the All-U.S. Plan will be as a matter of courtesy and transferring information on tidal power investigations and environmental impacts.

The Study Manager will coordinate all study activities, technical reviews, task assignments, scheduling, report preparation, funding, programming, etc. A public participation program will be conducted and public meetings, workshops, information briefings, etc., will be coordinated with the public during the course of the study. Input from the public, which includes agencies, private groups and individuals is desired for consideration, information and formulating project plans. During this study, the public is considered any agency, group or individual outside the Corps of Engineers. A partial listing

of agencies and organizations with which coordination will be carried out with, are shown on Attachment 5. Attachment 7 is a partial listing of laws requiring specific coordination.

The study will also be coordinated with typical public and private groups and industry such as: Organized publics, Sportsmen Clubs, Commercial Fishermen, Electrical Power Companies, industrial interests, etc.

Typical miscellaneous items of work in the project which will require coordination efforts during the study are:

Hydroelectric Power Investigation	Federal Energy Reg. Comm. Department of Energy
Public Highways	Federal Highway Admn.
Environmental Impact Statement	Env. Protection Agency
Project Planning	A-95 Clearinghouse
Scenic Areas and Project Site	National Park Service
Energy Resource	Federal Regional Council
Energy Marketing, Rate Structure, Economic Feasibility and Sales	Department of Interior (Southeastern Power Administration)
Electrical Transmission	Department of Interior (Bonneville Power Administration)
Economic Feasibility and Licensing, Power Values	Federal Energy Reg. Comm.
Coastal Zone Management Energy Planning Study Coordinator Environment	State of Maine Coastal Zone Management (Office of State Planning) (Energy Office) (Dept. of Environmental Protection)

5. Study Management Team

The Study Management Team will basically be composed of the following full-time types of personnel from the Planning Division, New England Division, Corps of Engineers:

Study Manager

Civil Engineer

Environmental Resource Specialist

Secretary

Public Participation Specialist (Part Time)

The team will be located in the New England Division headquarters, 424 Trapelo Road, Waltham, Massachusetts 02154. The Study Management Team may also be reached by telephone, on the following numbers:

Commercial	617/894-2400 Ext. 513
Federal Telepnone System	8-839-7513

The study team shall have available as needed the expertise of other Division personnel for engineering, planning, real estate, programming and environmental concerns for executing the study.

In addition, representatives of the following agencies/groups will serve as part of the study team on a part-time or as-needed basis for assisting with the study.

State of Maine

Department of Energy

Office of Planning

Coastal Zone Management

Department of Environmental Protection

Federal

National Marine Fisheries

U. S. Fish and Wildlife Service

Department of Energy

Bonneveille Power Administration

Southeast Power Administration

6. Technical Committee

In order to carry out the Tidal Power Study effectively, the input of a Technical Committee to assist the Corps of Engineers in the planning effortwould be most beneficial. The committee would meet on a semi-annual basis, at agreeable locations to be determined, to be informed of the progress of the study, assist in steering the study, public relations, offering technical advice, opinions and constructive criticism and recommendations.

Representatives (one each) of the following groups would comprise the Technical Committee:

State of Maine

State Planning Office

Office of Energy Resources

Coastal Zone Management

Department of Environmental Protection

Washington County

Washington County Regional Planning Commission

Washington County Economic Development Commission

Federal Agencies

Corps of Engineers (CE)

Environmental Protection Agency (Region I) (EPA)

Federal Energy Regulatory Commission (FERC)

Department of Energy, Region I (DOE)

Department of Commerce (National Marine Fisheries Service) (NMFS)

Bonneville Power Administration

Southeast Power Administration

Department of Interior (U.S. Fish and Wildlife Service) (F & WS)

U. S. Coast Guard (USCG)

Educational Institutions

University of Maine (U of M)

Industry

New England Power Pool (NEPOOL)

Maine Council for Economic Development

Environmental

Environmental Studies Center (University of Maine)

Public

Governor Appointee

Regional

New England Regional Commission (NERCOM)

New England River Basins Commission (NERBC)

New England Council

Citizens Review Panel (CRP)

Chairman of CRP

7. Citizens Review Panel

The Citizens Review Panel should comprise about 6-8 volunteer type citizens, officials, industrialists, etc. who would assist the study team in carrying out the public participation program and furnish advice as the study progresses.

8. Consultants

The Tidal Power Study will be large and the total expertise and workload envisioned is beyond the capabilities of the New England Division to accomplish all of the work with in-house personnel. In view of this, contracts will be awarded to various consultants and/or agencies to perform work assignments for the study. The consultants will actually be an "extension" of the study team and the results of all work will become the property of the Government.

The consultants shall be required to refer all questions from the public to the Corps of Engineers for response.

The consultant selection and awarding of contracts will be accomplished by the Corps of Engineers, New England Division in accordance with current Armed Services Procurement Regulations (ASPR). The Division Engineer and/or his designee will be the Contracting Officer and responsible for administering all contract awarded by the New England Division.

9. Canadian Observer

Canada is not participating in a joint study with the United States on tidal power in the Cobscook-Passamaquoddy Region at this time, principally because of their current involvement with commencing a $33,000,000 two-year advanced level study on a 1085 megawatt power project in Cumberland Basin in the upper portions of the Bay of Fundy. They have, however, designated Dr. R. G. Skinner, Environmental Advisor, Science and Technology, Department of Energy Mines and Resources, Ottawa, Ontario, as an observer to the Cobscook

Bay Study and it is anticipated that this arrangement will provide transfer of information and be beneficial to both studies.

10. Study Organizational Chart

The following organizational chart indicates the various elements involved in the study effortand their relationship to each other. (See Figure No. 4A)

ORGANIZATIONAL CHART

FOR THE

COBSCOOK BAY TIDAL POWER PROJECT STUDY

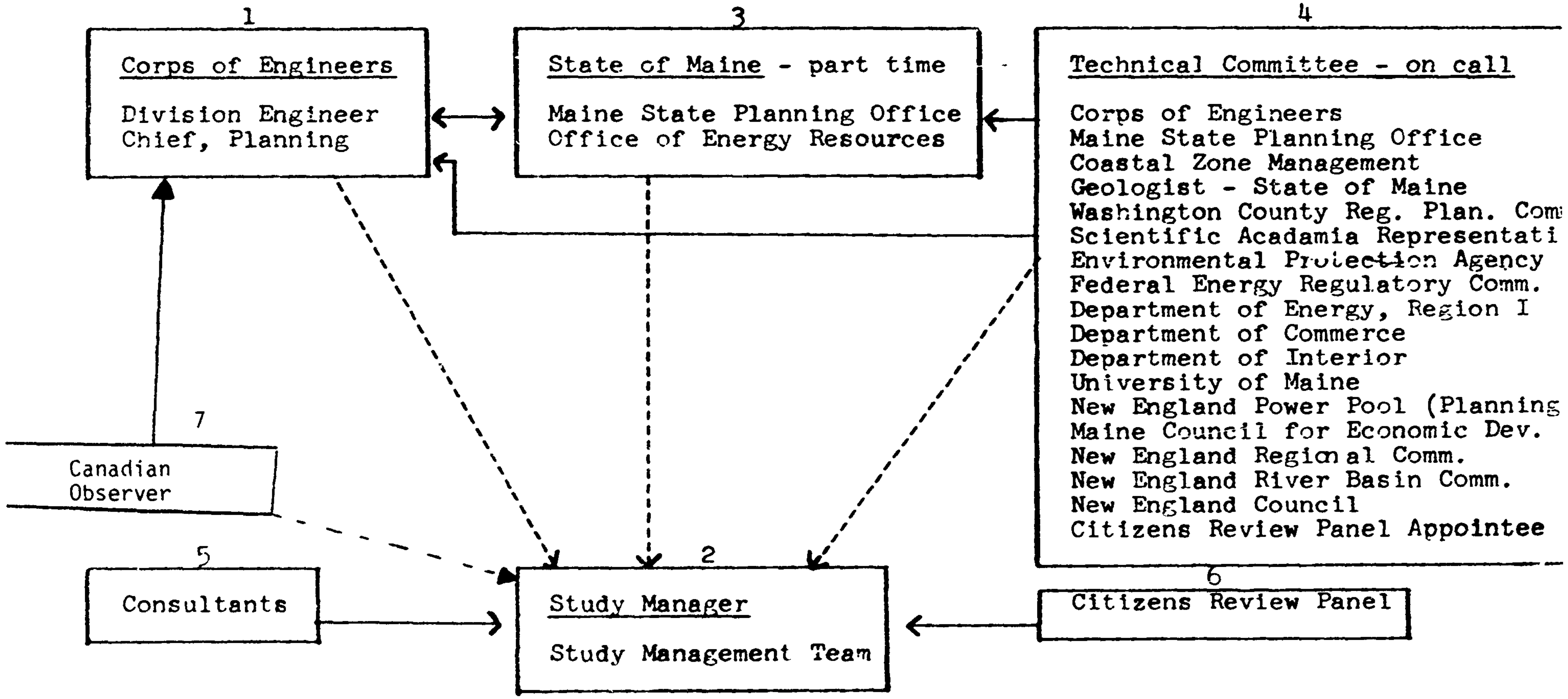

FIGURE NO. 4A

SECTION III

RECONNAISSANCE REPORT

SECTION III

RECONNAISSANCE REPORT

SECTION III
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III. RECONNAISSANCE REPORT (Cont'd)

III. <u>RECONNAISSANCE REPORT</u> (Cont'd)

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J. Results of Tidal Power Study by Energy Research and Development Administration

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L. Summary of Findings and Conclusions

M. Future Project Use

N. Public Involvement Program Results

O. Recommendations for Further Study

III. RECONNAISSANCE REPORT

A. Introduction

This section is a preliminary Reconnaissance Report and will briefly describe possible tidal power projects in Cobscook Bay, Maine, the study area and its problems and needs, the institutional arrangements related to the project; a summary of prior reports on the tidal power project and a list of ongoing studies in the area.

B. The Study Area

1. Physical

a. Location

Cobscook Bay is located in Washington County, Maine, the most easterly county in the United States and frequently called the "Sunrise County". A map of the study area is shown on Figure No. 2.

Shoreline towns which abut Cobscook Bay are:

City/Town	Population (1970)
Dennysville	278
Eastport	1989
Edmunds	165
Lubec	1949
Pembroke	700
Perry	878
Trescott	300
Whiting	269

b. Drainage Area and River Basins

The drainage of Cobscook Bay covers approximately 407 square miles and lies in the United States (See Figure No. 5). This area includes islands and portions of the shoreline not directly associated with any stream system as well as the following major streams which drain into the bay:

Draining into Cobscook Bay

Pennamaquan River
Hardscrabble River
Dennys River
Orange River

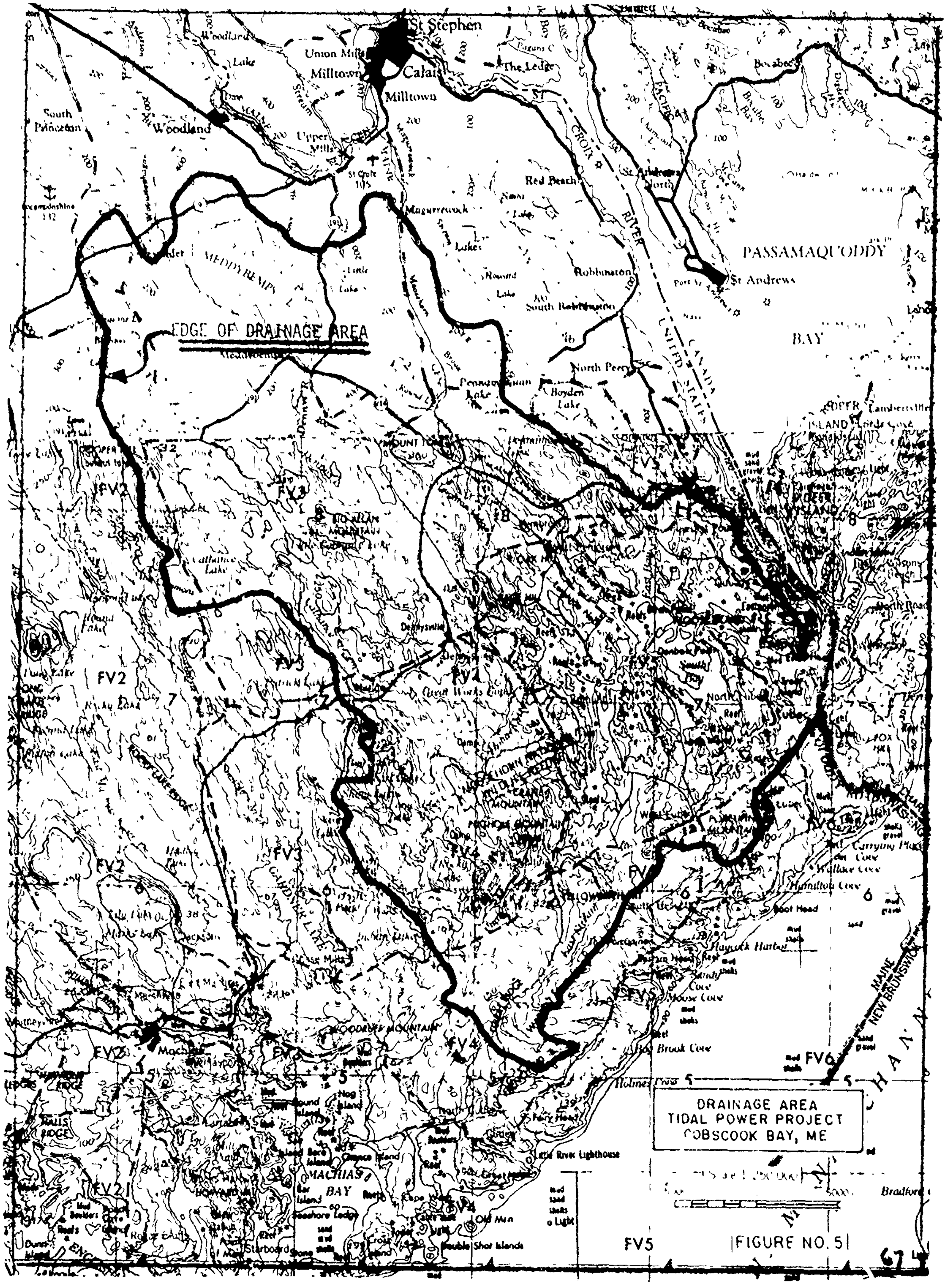
An important part of the study's Water Quality Program will be investigating the conditions of these streams as well as the bay.

c. The Bay

Cobscook Bay covers approximately 39 square miles at the high watermark and approximately 26 square miles at the low watermark. Cobscook Bay is entirely within the United States and is the principal bay area in this study. Some sub-bays included with "Cobscook" Bay are: Dennys, Pennamaquan, South Bay, Whiting Bay, Johnson Bay, Straight Bay and coves such as Half Moon Cove. Depths in Cobscook Bay range to 140 feet.

d. Tidal Action

Various agencies have intermittently measured the tides in the Cobscook Bay region and adjacent areas over the past 100 years. Tides are produced by the changing relationship of the sun, earth and moon with respect to each other. The tidal range, which is affected primarily by the phases of the moon, also varies from day to day. The tidal cycle occurs every 12 hours and 25 minutes. The range of the tides in Passamaquoddy and Cobscook Bays near the mouth of the Bay of Fundy varies from a minimum of 11.3 feet at neap tide to a maximum of 25.7 feet at spring tide, averaging 18.1 feet. During each tidal cycle, an average volume of approximately 70 billion cubic feet of water regularly enters and leaves the two bays. Approximately 17.3 billion cubic feet of water regularly enters and leaves Cobscook Bay at mean tide.


St Stephen
Calais
Milltown
Woodland
South Princeton
Red Beach
Robbinston
PASSAMAQUODDY
BAY
St Andrews
North Perry
Boyden Lake
EDGE OF DRAINAGE AREA
FV1
FV2
FV3
FV4
FV5
FV6
7
6
5
MACHIAS BAY
Cutler
Moose Cove
Holmes Cove
Little River Lighthouse
Old Man
Double Shot Islands
MAINE
NEW BRUNSWICK
DRAINAGE AREA
TIDAL POWER PROJECT
COBSCOOK BAY, ME
FIGURE NO. 5

The shorelines along the study area are exposed to waves generated in the Bay of Fundy, the Gulf of Maine and the Atlantic Ocean. Although these waves can be very violent as a result of the high winds and long northeast storms, the shore is sheltered by the many peninsulas and islands of the area.

e. Climatology

Onshore breezes blow several miles inland along the coast, bringing cooling trends in the summer and warming trends in the winter. The Labrador current flowing southward along the Nova Scotian coast brings cold water into the Gulf of Maine. This contributes to the abundance of precipitation, the prevailing westerly winds and average temperatures of 60^{o}F in the summer and 25^{o}F in the winter. Severe fog is encountered during the dark hours of the summer months.

Average annual precipitation is 43 inches and the average snowfall is 70 inches.

2. Geology of the Passamaquoddy/Cobscook Bay Region

a. General

The Cobscook area is part of the Appalachian province which includes mountainous and coastal lands and waters extending from Alabama to Newfoundland. The dominant regional northeast Appalachian trend of the bedrock has been locally modified by a combination of folding and faulting that has resulted in the juxtaposition of two bays, Cobscook Bay and Passamaquoddy Bay, each with a different type of natural bedrock barrier.

The unique distribution of land and water which make up Cobscook Bay is the surface expression of a thick succession of Silurian volcanic and sedimentary rocks that have been folded into a broad northeastwardly plunging anticline bordered by a northeast trending fault. The barriers across this bay consist of the folded resistant rocks of the Silurian succession.

Passamaquoddy Bay, in contrast, developed upon a basic structure formed by younger sedimentary rocks of Devonian age. Thus, Passamaquoddy Bay was developed on rocks which do not form a barrier for the bay. An effective bay barrier is, however, formed across its mouth by a group of islands consisting of older and dominantly volcanic rock. The northeast structural trends of the rock units are dragged around nearly at right angles as they approach the International Boundary. The course of this drag folding is a major fault which strikes north, northwest along the St. Croix River Channel and is assumed to extend continuously for 30 miles from Campobello Island to Oak Bay.

After Devonian time, this area was essentially a landmass sloping gently seaward. The project area was then uplifted, producing deep valleys in excess of 400 feet below present-day mean sea level conditions. In more recent Pleistocene time, the glacial ice advanced from the northwest and the area was depressed by the weight of the ice and debris. During the same period, the land was smoothed and the drainage system was modified. As the ice melted and unloaded the glaciated areas the land rose to regain partially the levels prevailing before glacial times. The passages around the island in the project area are the old

stream valleys, now partly drowned, and the numerous islands themselves are the higher parts of the preglacial land masses.

Erosion is now cutting through the thin mantle of glacial sediments deposited over the land surface. Several areas of outwash sand and gravel deposited by the glacier provide material sources for the project. It appears that glacial terminal moraines also blocked some of the principle passages causing the deposition of deep marine deposits of clay and silt in Cobscook and Passamaquoddy Bays.

b. Seismic History

The Cobscook Bay area is located in Zone 1 on the Seismic Probability Chart for the United States. The Seismic Zone map indicates that damage in this zone would be minor with a seismic coefficient .025 for design. A cursory review of available historical data reveals, however, that approximately 30 earthquake epicenters have been recorded within a 75-mile radius of the project area in the United States and Canada. Of this number, the majority of the earthquakes were in the intensity ranges of III to IV. However, the records indicate an earthquake of an intensity VIII occurred in the Bay of Fundy approximately 35 miles west of the site on 22 October 1869 at 11:00 a.m. E.S.T. and was felt over a 250,000 square mile area. This was followed on 8 February 1870 by another quake, presumably an aftershock, with an intensity of VI, slightly east and south of the first shock location. Closer to the site within the project area an earthquake of intensity VII occurred on 21 March 1904 at 6:00 a.m. This earthquake, recorded by the National Earthquake Information Service (NEIS) and the Earthquake History of the United

States (EHUS) was felt over an area of 150,000 square miles. The proximity to the site of these report epicenters will require further documentation as their presence may become the basis for design of structures.

3. Environmental Setting

a. Terrestrial Ecology

The major terrestrial impacts of the project will be associated with the construction aspects of the project. One major result of the project would be the creation of new habitat for waterfowl and aquatic mammal species by the creation of new salt marshes. In the literature available, there is little information on the terrestrial ecosystem.

In the publications from Acadia University, studies were conducted of the avifauna and shorebirds in the Bay of Fundy. The birds utilize the inlets and estuaries as feeding and resting areas during their migrations. The following information will be studied: distribution of shorebirds in the project area, impacts on their migrations, and availability of food resources.

b. Vegetation

The main type of vegetation which will be impacted upon would be the algae population. Productivity and population statistics will have to be studied. Also, vegetation on the surrounding islands has to be analyzed. Forestry resources and productivity from the surrounding lands are going to be an important factor in studying the project.

Plan ecology, mannals, wildlife, and herpetofauna are part of the overall terrestrial environment. Analyses for productivity, resources and management, as done for Dickey-Lincoln, would have to similarly be done for Cobscook Bay.

c. Rare and Endangered Species

The Arctic Peregrine falcon and the Northern bald eagle have been ovserved in the area. "Great Whales," such as finback, minke and right whales are found in the Bay area. Except for the minke whale, all of the species of "Great Whales" are on the Department of Interior's Endangered Species list. Consultation and coordination will be undertaken under Section 7 of the Endangered Species Act of 1975 with the Department of the Interior.

d. Aquatic Ecology

A high species diversity of marine benthic communities are found, including many species of crabs, shrimp, lobsters, clams and barnacles. The important commercial species are soft-shell clams, lobsters, shrimp, and scallops; and finfish, such as cod, haddock, herring, hake, redfish, pollock, and flounder. Salmon, striped bass, and brook trout are the sport fish which are found.

An intensive analysis of the intertidal resources in the Bay has to be conducted in order to predict changes following the construction of a tidal power plant. According to M.L.H. Thomas from Acadia University, there is almost no knowledge of the ecological dynamics of intertidal systems in the Bay area. The intertidal communities are very diverse. Commercially important intertidal species from the Bay of Fundy are: soft-shell clam (*Mya arenaria*), Irish moss (*Chondrus crispus*), Dulse (*Palmaria palmata*), Knotted Wrack (*Ascophyllum nodosum*), Common periwinkle (*Littorina littorea*), and the bloodworm (*Glycera dibranchiata*).

Aquatic mammals inhabiting the study area include harbor porpoises, white-beaked and white-sided dolphins and harbor and gray seals. "Great Whales," such as finback, minke whale, all of the "Great Whales" species are on the Department of Interior's endangered species list.

This area constitutes an important feeding and breeding area for marine birds. Migrating, resident and shore birds all live here for at least part of their life cycle.

e. Fisheries

There are over 40 fish species that are resident or migrate through the Bay of Fundy. The effects of the tidal power plant on pelagic fish species would be on their feeding and reproduction. As a result of the reduced intertidal zone, their primary food source of intertidal benthic organisms would be reduced. Spawning and rearing would also be affected. Most of the species use the estuaries, salt marshes or freshwater river for spawning and rearing. The project could affect them in different ways, i.e., extended salt marshes could benefit some, while the reduction of the intertidal zone would be detrimental to others.

Anadromous species would be most severely impacted on. Atlantic salmon, shad, alewives, smelt and striped bass migrate through to use freshwater for spawning. "Migration of anadromous species could be blocked by the conditions experienced at the sluiceways: a negative current, flow downward into a dark submerged tunnel, no olgactory clues. Thus, adult salmon are more likely to concentrate in the area of the powerhouse discharge. Fish mortality at the turbines

would depend on the extent of active or passive passage through the turbines and the degree of induced mortality. Groundfish are also more likely to be entrained in the powerhouse as a result of their lesser swimming ability."

Passamaquoddy Bay has active fisheries in lobster, clams, clamworms and groundfish such as shrimp and flounder. The most important fishery is for soft-shell clams.

Fish Presence and Abundance and current fisheries surveys are required; also, species for potential introduction.

f. Mariculture

Potential species for mariculture are Atlantic salmon, trout, lobster, oysters, mussels and snails.

A detailed study plan has to be developed to identify the best species for mariculture. economical benefits and losses, and the overall potential of mariculture.

g. Climatology and Air Quality

Conditions of Climatology and Air Quality can be found in the report done on the Pittston Oil Refinery Project in Eastport, Maine. Assessment of the impacts of the proposed project on the meso-climate and possible air quality degradation will have to be looked at.

4. Cultural Resources

Archaeological work has been conducted along the coastal regions of Maine and New Brunswick. It is certain that the area was utilized and inhabited by aboriginal populations by at least 2,500 years ago. Although there is very little information available in published

form, a general picture emerges that indicates potential for significant and valuable resources concerning human exploitation of the area during aboriginal and historic times.

A Cultural Resource Reconnaissance will be conducted covering the project area. The results of this study will locate and define the nature and scope of cultural resources in the area. During subsequent planning phases, studies will determine the significance of the resources and the impact the project would have.

5. Socio-Economic Aspects

a. Population

The study area is located in the easternmost portion of Maine in Washington County. Washington County occupies 2,554 square miles, 85 percent of which is forested land. Its 1970 population was 29,859 with a population density of 11.7 people per square mile. Most of the county's residents live in the southern coastal areas. Rural in nature, only 13.5 percent of the county's population is calssified as urban. Associated with the sparse development of the county is the reduction in full time employment opportunities, resulting in an out-migration from the county. Between 1960 and 1970 the Washington County's population declined by 9.3 percent (Table 1).

The decline in population in Washington County, and especially in Eastport, the community closest to the site, is due to the remote location and the decline in industries, principally fisheries. Between 1970 and 1973, however, a small increase in population was experienced in both Washington County and Eastport. These increases,

TABLE 1

POPULATION CHARACTERISTICS OF TOWNS WITHIN A 40-MILE RADIUS OF EASTPORT[1]

Community	1970 Population	Percent Change 1960-1970	Distance From Eastport (in miles)
Eastport	1,989	-21.6	-
Lubec	1,949	-27.4	1
Perry	878	55.7	2
Pembroke	700	-19.6	5
Dennysville	278	-8.3	7
Unorganized Territory of East Central Washington	498	NA	9
Robbinston	396	-16.8	11
Whiting	269	-20.6	11
Charlotte	199	-23.5	12
Cutler	588	-10.1	13
Calais	4,044	-4.2	16
Unorganized Territory of Baring	181	NA	16
Cooper	88	-17.0	17
Meddybemps	76	-11.6	17
East Machias	1,057	-11.8	20
Alexander	169	-23.2	21
Baileyville	2,167	16.3	22
Machiasport	887	-9.5	24
Marshfield	227	-15.0	25
Machias	2,441	-6.6	25
Machias Center	1,368	-10.2	26
Crawford	74	-10.8	26
Woodland (U)	1,534	10.1	26
Northfield	57	-27.8	27
Wesley	110	-24.1	28
Whitneyville	115	-30.3	29
Princeton	956	15.3	28
Jonesboro	448	4.7	30
Plantation No. 21	83	48.2	30
Unorganized Territory of North Washington	793	NA	32
Jonesport	1,326	-15.2	36
Columbia Falls	367	-17.0	36
Great Lake Stream Plantation	186	-15.1	38
Addison	773	3.9	38
Washington County Total	29,859	-9.3	-

[1]Source: U.S. Department of Commerce, Bureau of the Census, Number of Inhabitants, Maine, 1970.

resulting in populations of about 31,700 and 21,000 respectively, were on the order of 6 percent and were attributed largely to an influx of elderly, retired couples, returning former residents and urban dwellers seeking new lifestyles. Retired couples make up the largest group of newcomers to the Eastport-Pembroke area.

The population center nearest to Eastport is the city of Bangor in Penobscot County. Bangor, approximately 84 miles west of Eastport, had a 1970 population of 33,168.

The largest city in the county is Calais with a population of about 4,000. It serves as the regional shopping center for Washington County and nearby Canadian communities. In addition, being the northern terminus of U.S. Route No. 1, Calais is the major border crossing to Canada from Maine. Machias, the second largest city in Washington County with a population of 2,700 serves as a principal shopping center.

Out-migration of young people is evident in Table 2, which shows the age distribution of Washington County population. In 1970 the median age was 43.7 years in Eastport, 33.4 in Washington County and 29.3 in the U.S. Eastport's 1970 master plan noted the following: "The young working-age population has been consistently leaving Eastport to seek employment in other areas where jobs were more readily available at higher income levels." Area officials report that this exodus of young people has continued through today.

The population projections in Table 3 assume a lessening of out-migration and an increased industrial base.

TABLE 2

AGE DISTRIBUTION
WASHINGTON COUNTY[1]

Age Group	1970	1960	Net Change
0-4	2,357	3,394	-1,037
5-9	2,684	3,201	- 517
10-14	3,040	3,092	- 52
15-19	2,612	2,330	+ 282
20-24	1,814	1,573	+ 241
25-29	1,458	1,805	- 347
30-34	1,423	2,100	- 677
35-39	1,583	2,049	- 466
40-44	1,803	2,013	- 210
45-49	1,769	1,899	- 130
50-54	1,685	1,811	- 126
55-59	1,592	1,678	- 86
60-64	1,604	1,664	- 60
65-69	1,418	1,458	- 40
70-74	1,200	1,190	+ 10
75+	1,817	1,651	+ 166

[1]Source: U.S. Department of Commerce, Bureau of the Census, General Population Characteristics, Maine, 1970.

TABLE 3

POPULATION PROJECTIONS FOR EASTPORT AND WASHINGTON COUNTY[1]

Eastport

Age Group	1975 Population	1980 Population	1985 Population	1990 Population
0-4	170	261	215	275
5-9	249	246	256	215
10-14	242	238	252	262
15-19	213	179	244	258
20-24	148	121	183	249
25-29	70	139	123	186
30-34	102	162	142	126
35-39	148	158	165	144
40-44	140	155	160	167
45-49	144	146	156	161
50-54	135	139	146	156
55-59	125	129	137	143
60-64	117	128	124	131
65-69	111	112	119	115
70-74	98	92	98	103
75+	107	129	116	105
Total	2,319	2,534	2,636	2,796

Washington County

Age Group	1975 Population	1980 Population	1985 Population	1990 Population
0-4	2,266	3,394	2,724	3,393
5-9	3,319	3,201	3,244	2,649
10-14	3,228	3,092	3,194	3,237
15-19	2,846	2,330	3,086	3,188
20-24	1,969	1,573	2,318	3,070
25-29	932	1,805	1,563	2,302
30-34	1,354	2,100	1,793	1,553
35-39	1,974	2,049	2,082	1,779
40-44	1,866	2,013	2,025	2,061
45-49	1,917	1,899	1,978	1,991
50-54	1,793	1,811	1,846	1,925
55-59	1,665	1,678	1,728	1,761
60-64	1,560	1,664	1,569	1,618
65-69	1,485	1,458	1,500	1,417
70-74	1,305	1,190	1,237	1,267
75+	1,432	1,651	1,469	1,302
Total	30,918	32,808	33,368	34,518

[1]Source: R. W. Booker and Associates, Inc., A Comprehensive Development Plan - Eastport, Maine, 1970.

b. Employment and Income

Washington County has an abundance of underdeveloped natural resources, principally forestry and marine resources. Over 80 percent of the county's lands have commercial value, but only 70 percent is currently being utilized. Washinton County has approximately 700 miles of coastline, the potential for a major fishing industry is limited, however, since Federal support of this industry has been traditionally weak and commercial fish are decreasing in number. Because of Washington County's abundance of natural resources, the tourist trade could become quite profitable. While tourism has not developed fully in Washington County because of its remote location, improved transportation may attract more people to the area. At present, there are no plans to improve inter-county transportation.

Manufacturing, wholesale and retail sales and government services are the three major employment sectors in Washington County. The U.S. Census indicated that about 9,490 persons were employed here in 1970, 31 percent in manufacturing, 11 percent in agriculture/forestry/fisheries, 5 percent in transportation/communications/utilities, 8 percent in construction, 17 percent in wholesale/retail trade, 2 percent in public administration. Table 4 shows a total workforce decrease of 6 percent and a significant shift in distribution since 1950. The number of employed decreased 48 percent in agriculture/forestry/fisheries, 9 percent in manufacturing and 34 percent in transportation/communications/utilities, while employment increased 19 percent in trade and 17 percent in public administration. The largest increase occurred in the banking/insurance/

Table 4
EMPLOYMENT BY INDUSTRY
WASHINGTON COUNTY, MAINE

Industry	1950	1960	1970	% Change 1950/70
Agriculture	830	468	--	
Forest & Fisheries	1129	430	--	
Subtotal	1959	898	1016	-48
Mining	18	12	7	--
Construction	620	1244	742	-20
Subtotal	638	1256	749	
Manufacturing				
- Wood Products	1071	946	417	-61
- Food & Kindred	1115	726	678	-39
- Other	1079	1375	1865	+72
- Subtotal	3265	3047	2960	- 9
Transportation	513	337	258	-50
Communications/Utilities	181	176	197	- 9
Wholesale & Retail Trade	1348	1488	1587	18
Banking/Insurance/Real Estate	92	110	235	155
Services	1523	1474	1827	20
Subtotal	2963	3072	3649	
Public Administration	446	511	661	48
Other	169	247	--	--
Total	10,134	9542	9490	- 6

Notes

- 1970 figures include 14 to 15 year olds. Including these would increase total to 9636.
- Source: U. S. Bureau of the Census, "General and Social Characteristics", 1950, 1960 and 1970.

real estate category.

The employment decline in the agriculture/forestry/fisheries industries over this 20-year span reflects the overall decline in fish resources off the northeast Atlantic Coast and the decrease in the number of acres farmed from 37,000 in 1949 to 17,000 in 1969. However, in the past couple of years, commercial fisheries have increased slightly. According to records of the Maine Department of Marine Resources, total fishing licenses for Washington County increased from 2,995 in 1973 to 3,004 in 1974. The majority of the recently issued commercial fishing licenses were for lobster and crab, although other marine species fished include scallops and marine worms.

The decrease in manufacturing employment between 1950 and 1970 is due largely to the decline of the sardine canning industry. At the turn of the century when Eastport was a thriving city of 5,300, 16 sardine processing plants were operating within its boundaries, earning it the nickname "Sardine Capital of the World." In 1900, 2200 people were employed in the industry. Today, only one sardine cannery with a seasonal peak labor force of 100 remains. This operates only part-time when fish are available and it is expected to close permanently within the next two to three years. Two additional sardine packing plants are located at Lubec.

The industrial sector in Eastport includes Guilford Industries, a wool spinning mill, Holmes Packing Corporation, the remaining sardine cannery, and Mearl Corporation. In 1974, 374 persons were employed in manufacturing work.

The largest year-round manufacturing employer in the county is a pulp and paper mill located in Woodland that is operated by the Georgia Pacific Company.

In 1970, half of those employed in the county were blue collar workers, an unusually large proportion of whom were nonfarm laborers, almost 13 percent versus 6 percent for the State. Seventeen percent were classified as craftsmen, foremen and kindred workers versus 15 percent for the whole State. Fewer than 9 percent were considered professional versus 12 percent for the State (Table 5). Washington County, especially Eastport, is affected by declining industry and out-migration of the young. Unemployment for Washington County and Eastport is 13 and 46 percent, respectively. The economic base of Washington County and Eastport is being weakened not only by out-migration but also the seasonal nature of employment. As indicated in Tables 6 and 7, the months of highest employment are June and July. Because of seasonal employment, personal income in Washington County is low. The median family income in 1970 in Washington County was $6,137. Nineteen percent of the families were classified below the State poverty level of $5,038 and only 6.5 percent of the families had incomes above $15,000.

Although Washington County wages are below the State average, they did increase between 1974 and 1975. The only category experiencing a wage decrease was agriculture, which follows the national trend. The number of coastal farms in Maine has declined because of increasing land values and competition for coastal lands. Table 8 is a breakdown of wages in Washington County by industry.

TABLE 5

OCCUPATIONAL CATEGORIES: WASHINGTON COUNTY AND MAINE

Occupation	Washington County Number	Washington County %	Maine Number	Maine %
Professional, technical & kindred	803	8.5	44,924	12.3
Managers/Administrators, Ex Farm	794	8.4	32,234	8.8
Sales Workers	478	5.0	21,005	5.7
Clerical & Kindred Workers	1,072	11.3	50,611	13.8
Craftsmen, and Kindred Workers	1,600	16.8	55,148	15.1
Operatives, except transport	1,567	16.5	68,978	18.9
Transport Equipment Operatives	471	5.0	15,085	4.1
Laborers, except farm	1,203	12.7	22,195	6.1
Farmers and farm managers	172	1.8	4,806	1.3
Farm laborers & farm foremen	244	2.6	5,340	1.5
Services, ex private household	920	9.7	39,875	10.9
Private household workers	166	1.7	5,649	1.5
Total All Workers	9,490	100.0	365,850	100.0

Source: U. S. Bureau of the Census, 1970 Census of Population, "General Social and Economic Characteristics."

TABLE 6

1975 EMPLOYMENT FOR WASHINGTON COUNTY(1)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Avg.
Nonfarm Wage and Salary	7,450	7,350	7,200	7,350	7,550	8,100	8,300	8,650	8,250	8,350	8,100	7,850	7,900
Manufacturing	2,250	2,200	2,100	2,150	2,100	2,550	2,700	3,050	2,750	2,750	2,550	2,300	2,450
Durable Goods	430	420	300	250	260	440	440	440	410	510	510	530	410
Nondurable Goods	1,820	1,780	1,800	1,900	1,840	2,110	2,260	2,610	2,340	2,240	2,040	1,770	2,040
Nonmanufacturing	5,200	5,150	5,100	5,200	5,450	5,550	5,600	5,600	5,500	5,600	5,550	5,550	5,450
Contract Construction	360	290	260	270	390	400	400	360	360	430	420	420	390
Communication, Public Utilities, and Transportaion	320	300	290	300	300	320	320	320	320	330	320	320	310
Wholesale and Retail Trades	1,370	1,350	1,340	1,400	1,480	1,560	1,640	1,690	1,580	1,560	1,530	1,520	1,500
Finance, Insurance, and Real Estate	170	160	160	170	180	170	190	190	170	150	150	150	170
Services	1,130	1,130	1,110	1,120	1,160	1,170	1,260	1,270	1,210	1,200	1,180	1,190	1,180
Government	1,850	1,920	1,940	1,940	1,940	1,930	1,790	1,770	1,860	1,930	1,950	1,950	1,900

(1)Source: Maine Department of Manpower Affairs, Selected Lab Market Information Pertaining to the Passamaquoddy Tidal Power Study, August, 1976.

TABLE 7

CIVILIAN LABOR FORCE - 1970-1975, WASHINGTON COUNTY(1)

Year		Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Avg.
1975	Civilian Labor Force	12,960	12,900	12,910	12,830	12,700	13,160	13,170	13,830	12,640	12,530	12,380	12,520	12,880
	Unemployment	2,000	2,170	2,30	2,010	1,850	1,590	1,320	1,250	1,170	1,320	1,460	1,800	1,680
	% of Civilian Labor Force	15.4	16.8	17.3	15.7	14.6	12.1	10.0	9.0	9.3	10.5	11.8	14.4	13.0
	Residents Employed	10,960	10,730	10,680	10,820	10,850	11,570	11,850	12,580	11,470	11,210	10,920	10,720	11,200
1974	Civilian Labor Force	12,840	12,870	12,680	13,140	13,310	14,620	14,720	15,770	14,070	13,760	13,350	13,490	13,720
	Unemployment	1,350	1,510	1,590	1,580	1,400	1,130	930	700	690	790	1,100	1,380	1,180
	% of Civilian Labor Force	10.5	11.7	12.5	12.0	10.5	7.7	6.3	4.4	4.9	5.7	8.2	10.2	8.6
	Residents Employed	11,490	11,360	11,090	11,560	11,910	13,490	13,790	15,070	13,380	12,970	12,250	12,110	12,540
1973	Civilian Labor Force	12,610	12,560	12,610	12,670	12,780	13,470	13,910	14,990	13,260	12,920	12,490	12,330	13,050
	Unemployment	1,570	1,700	1,680	1,820	1,620	1,080	840	680	690	700	960	1,030	1,200
	% of Civilian Labor Force	13.0	14.2	13.6	14.6	12.5	7.7	5.9	4.3	4.9	5.2	7.4	8.0	9.0
	Residents Employed	10,490	10,280	10,660	10,660	11,360	12,860	13,420	15,190	13,240	12,650	11,990	11,860	12,060
1972	Civilian Labor Force	12,610	12,560	12,610	12,670	12,780	13,470	13,910	14,990	13,260	12,920	12,490	12,330	13,050
	Unemployment	1,290	1,500	1,540	1,880	1,990	1,060	870	610	510	770	760	1,130	1,150
	% of Civilian Labor Force	10.2	11.9	12.2	14.8	15.6	7.9	5.6	4.1	3.8	5.9	6.1	9.2	8.8
	Residents Employed	11,320	11,060	11,070	10,790	10,790	12,410	13,130	14,380	12,750	12,150	11,730	11,200	11,900
1971	Civilian Labor Force	11,570	11,900	11,460	11,800	12,200	12,600	13,430	13,940	12,820	12,600	12,260	12,550	12,430
	Unemployment	1,500	1,450	1,370	1,620	1,640	1,110	1,000	780	810	970	1,000	1,120	1,200
	% of Civilian Labor Force	12.9	12.2	11.9	13.7	13.4	8.8	7.4	5.6	6.3	7.7	8.2	8.9	9.6
	Residents Employed	10,070	10,450	10,090	10,180	10,560	11,490	12,430	13,160	12,010	11,630	11,260	11,430	11,230
1970	Civilian Labor Force	11,580	11,690	11,340	11,750	11,660	12,840	13,030	13,110	12,310	11,980	11,720	11,540	12,050
	Unemployment	1,610	1,540	1,450	1,660	1,550	1,040	750	750	670	870	940	1,090	1,160
	% of Civilian Labor Force	13.9	13.2	12.8	14.1	13.3	8.1	5.8	5.7	5.4	7.3	8.0	9.4	9.6
	Residents Employed	9,970	10,150	9,890	10,090	10,110	11,800	12,280	12,360	11,640	11,110	10,780	10,450	10,890

(1)Sou : Maine Department of Manpower Affairs, Selected L r Market Information Pertaining to the Passamaquoddy Tidal Power Stud, August, 1976.

TABLE 8

**WAGES FOR WASHINGTON CO.
1974 AND 1975[1]
(IN DOLLARS)**

Industry	Total Wage 1974	Average Wage 1974	Total Wage 1975	Average Wage 1975
Agriculture, Forestry, and Fisheries	88,355	5,522	85,193	4,732
Mining	51,614	3,970	78,404	4,612
Contract Construction	3,276,902	6,913	3,337,958	9,120
Manufacturing	20,546,477	7,288	20,657,076	8,532
Communications Public Utilities and Transportation	2,149,794	8,05[illegible]	2,176,194	8,992
Wholesale and Retail Trade	7,219,569	5,113	8,134,797	5,652
Finance, Insurance, and Real Estate	881,773	6,436	1,064,063	6,820
Services	4,008,600	4,570	5,223,717	5,807
State Government	1,304,022	9,804	1,501,252	9,562
State Total	2,112,076,309	7,353	2,227,231,297	7,895
Washington Co. Total	39,527,109	6,429	42,258,659	7,197

[1] SOURCE: Maine Department of Manpower Affairs, Selected Labor Market Information Pertaining to the Passamaquoddy Power Study, August, 1976.

TABLE 9

COMPARATIVE ECONOMIC STATUS
OF WASHINGTON COUNTY RESIDENTS 1970

Area	Median Income	Percent Families Below Poverty Level	Percent Above $15,000
Washington County	$ 6,137	19.0	6.5
Maine	$ 8,204	10.3	11.2
New England	$10,617	6.7	24.2
United States	$ 9,590	10.7	20.6

Source: U.S. Bureau of the Census, 1970 Census of Population, "General Social and Economic Characteristics."

The average 1972 per capita income in Eastport was only $2,118. This was 14 percent below the county level, 30 percent below the State level and 45 percent below the national average. This low value is due primarily to the reduction of the city's industrial base, which historically has been sardine canning.

Although unemployment is an indicator of the economic status of an area, Eastport cannot be characterized by unemployment data alone because many individuals do not meet the minimum requirements, insufficient work period; for example, for obtaining unemployment benefits. Other useful indicators of the area's economic status are the number of welfare and food stamp recipients. As of January 24, 1976, 190 of Eastport's 600 to 650 families were receiving food stamps, and 40 families were receiving welfare. Knowledgeable officials in Eastport have estimated that unemployment was close to 22 percent in August 1975, when seasonal employment was at its high point for the year, and rose to 43 percent in January 1976.

c. Housing

A 1975 housing survey undertaken by the Washington County Regional Planning Commission shows that the overall housing situation has not changed significantly since the 1970 U.S. Census: single-family homes continue to account for more than 80 percent of the year-round housing stock and a vacancy rate of 3 percent has remained constant for the past five years.

Mobile homes, however, increased from 6 percent of the total housing stock to almost 10 percent during those five years. In Calais, which is Washington County's richest community, mobile homes made up 42 percent of the new home construction between 1970 and 1975.

Eastport's housing conditions are similar to the rest of Washington County. Most of the units are single family and in good or acceptable condition, although the median value for a single-family home in Eastport was only $5,200 in 1970, 28 percent less than the county median value of $7,200. According to the 1975 County Survey, the number of single-family homes was 817 and the number of mobile homes was 52, with the total number of living units listed as 926. The 1970 U.S. Census reported that only 4 percent of the occupied units had more than one person per room. Table 10 summarizes the 1975 Washington County Survey.

The low valuation of Eastport housing is due in part to its age: the 1970 U.S. Census found that 73 percent of its year-round housing was constructed before 1940. However, the city has a program to reduce the number of structures classified as deteriorated or abandoned

TABLE 10

1975 YEAR ROUND HOUSING IN WASHINGTON COUNTY AND EASTPORT, MAINE

	Washington County		City of Eastport	
	Number	%	Number	%
Type of Homes				
• Single Family	8,709	81	817	88
• Mobile	1,060	10	52	6
• Vacant	267	3	35	4
• Other Units	693	6	22	2
• Total	10,729	88	926	100
Condition				
• Good or Acceptable	9,455	88	805	87
• Poor to Very Poor	1,274	12	121	13
• Total	10,729	100	926	100

Sources:

- Washington County Regional Planning Commision, County Housing Survey, Preliminary Data, 1975.
- Calais, Maine Community Development Application, 1975.

by either removing or upgrading them. As a result, the number of deteriorated units in Eastport has dropped from 391 in 1960 to 227 in 1970 and to 212 in 1975.

Few new units are being added to the Eastport housing stock. Those being erected are either mobile, modular or self-built by their owners. The only significant new construction in Eastport is a 16-unit development for the elderly, funded by a loan from the U.S. Farmers Home Administration, which is the source of most of Washington County's financing for new housing. There has been some new publicly funded construction on the nearby Passamaquoddy Indian Reservation at Pleasant Point.

d. Taxes

In 1975, Eastport's property was assessed by State authorities at 11.7 million dollars, a figure that is intended to closely reflect the market value. This compares with a local tax assessment value of only $5,726,000 which is now being adjusted upward to conform with the State's figures. Approximately 26 percent of this tax base is commercial and industrial property.

Local taxes, consisting principally of the property tax, provide less than half of the city's revenue. The remaining funds are obtained largely from Federal and State programs and from the surrounding communities whose students attend Eastport's high school. The State takes a portion of each community's property tax revenues and then redistributes these funds to the municipalities on a per pupil basis. The State has a 5 percent sales and use tax in addition to other selective

sales and gross receipt taxes. These State taxes provided 73 percent of Maine's tax revenue in 1973, while corporate and personal income taxes contributed 14 percent. Maine residents pay a larger proportion of their income for State and local taxes than most other New England residents. In 1975, Eastport received $300,000 for educational purposes from the State with the remaining $171,000 for schools coming from the city's total 1975 expenditures of $809,000.

e. Land Use

Of the 6,700 acres encompassed by Eastport's municipal boundaries, only 2,300 or less than 35 percent is land. The remaining 4,400 acres are covered by water.

The majority of Eastport's residents live in the city's center at the southeastern end of the island, although a small group live on the northwestern end in Quoddy Village. This development was built in the 1930's to house Army Corps of Engineers personnel undertaking field survey work for the proposed Passamaquoddy Tidal Power Project. The only major developments in the city since then have been the airport, the Hillside Cemetery and a State funded fish processing plant that failed.

Of the 34 percent of Eastport that is not covered by water bodies, 21 percent is open space, mostly forested, and 13 percent is developed. In developed areas, 21 percent is residential, 3 percent is commercial and 30 percent is industrial. Most of the residences are concentrated in the center of town, while commercial establishments are scattered throughout or are located along the waterfront. With the exception of two firms, the city's industries are also along the waterfront or are located on the edge of the residential area. Table 10 shows land use.

TABLE 11
EXISTING LAND USE
EASTPORT[1]

6

Land Use	Acres	Percent Total City Area	Percent Total Developed Area
Single-Family Residential	185.23	2.77	21.03
Multi-Family Residential	0.10	-	0.01
Office-Service Business	2.16	0.03	0.25
Retail Business	21.45	0.32	2.44
Residential Business	2.32	0.03	0.26
Fishing-Oriented Industry	220.77	3.30	25.07
Other Industry	29.26	0.43	3.32
Warehouse and Storage	11.15	0.17	1.27
Public Facility	270.34	4.04	30.70
Semi-Public Facility	6.46	0.10	0.73
Streets and Roads	99.10	1.48	11.25
Railroad	32.29	0.48	3.67
Total Developed Area	880.63	13.15	
Vacant, Agriculture and Open Space Land	1,409.37	21.04	
Water Areas	4,408.00	65.81	
Total City Area	6,698.00		

[1]Source: R. W. Booker and Associates, Inc., A Comprehensive Development Plan, Eastport, Maine, 1970.

The remainder of Washington County is similar in that most of its inhabitants also reside in small coastal communities. Most of its land area, which consists of 1.86 million acres or 2,900 square miles and extends some 85 miles north to south and 55 miles east to west, is in commercial forest use. Only 1 percent of its land is in urban use; 13 percent is wetlands and waterways; 1 percent is farmland largely devoted to low bush blueberry crops; and 70 percent is commercial forest. Except for the Georgia Pacific Company's paper mill in Woodland, there are no major industrial areas or complexes in the county.

f. Transportation

Transportation facilities are limited in the Eastport area. The only State road to Eastport is Route 190, a paved two-lane highway. Route 190 is linked to the major regional highway, U.S. Route 1 at Perry, approximately six miles northwest of Eastport. Average daily traffic flow (1972) on Route 190 in Eastport was recorded at 2,140 vehicles; in Quoddy Village at 2,045 vehicles and at the junction of U.S. Route 1 at 1,995 vehicles.

The only rail facility at Eastport is a spurline of the Maine Central Railroad, but its use is limited. In 1973, 14 shippers used the line; presently only one shipper uses it. Because the line is only in fair condition, the Maine Central Railroad has petitioned the Interstate Commerce Commission to abandon the line.

Eastport, with its deep water harbor, has the physiographic potential to become a major shipping port. At the present time, it is used mostly by local fishermen.

Plans are currently being considered for a proposed major oil refinery and marine terminal to be located at Eastport. It is estimated that ship traffic in and out of Eastport would be one 250,000 DWT and seven 76,000 DWT tankers per week and two barges daily.

Eastport has an airport that was constructed in the 1940's as a special national defense facility. It has two runways, approximately 2,850 feet in length, that are in poor condition and consequently limit the use of the facility. The Lubec Municipal Airport, with one 2,032 foot runway that is in fair condition, is two miles west of Lubec. The Eastport Airport may be discontinued and is the site of the proposed oil refinery.

g. Public Services

The public school system in Washington County consists of 38 elementary schools and 8 secondary schools. Eastport has two elementary schools with a total enrollment of 328 and one high school with an enrollment of 231. Eastport's Comprehensive Development Plan includes a Community Facilities Plan which proposes a new school complex to accommodate an increased enrollment.

Located in Eastport is Eastport Memorial Hospital, with a capacity of 26 beds. Other health facilities in the area include one hospital at Calais, approximately 16 miles northwest from Eastport, and another at Machias, approximately 25 miles southwest of Eastport. These hospitals have a total capacity of 109 beds.

Eastport's water is supplied by a private utility from a reservoir, Boyden Lake, just northwest of Perry. Boyden Lake

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Eastport's water is supplied by a private utility from a reservoir, Boyden Lake, just northwest of Perry. Boyden Lake

can supply 12 million gallons per day. An emergency supply source with a capacity of 750,000 gallons per day is located on Route 90. Average daily use in Eastport is approximately 300,000 gallons. Peak daily consumption was 450,000 gallons per day in 1972.

At the present time, Eastport has no sewage treatment facility, and although raw waste is discharged into Passamaquoddy Bay, plans for an area sewage treatment plant are being investigated.

h. Recreational Facilities

Washington County's primary recreational facilities are its forests and water bodies which offer good opportunities for camping, hiking, hunting, fishing, boating and snowmobiling. These areas are within easy access to Eastport and include six public park developments; the 531-acre Quoddy Head State Park in Lubec, the 686-acre Cobscook State Park in Edmunds, Gleason Point in Perry with 100 acres, Reversing Falls Park in Pembroke, and St. Croix National Park in Robbinston. In addition, adjacent to Washington County on Canada's Campobello Island is the Roosevelt Memorial Park.

However, there are no major commercial centers to cater to these activities. The only commercial facilities are motel accommodations, mostly seasonal, designed for overnight summer motorists. None of these are in Eastport and, except for a restaurant which opens during the three summer months, the Waco Diner provides the only eating and drinking fare in the city.

Except for one small camping area on Carryingplace Cove, which is owned by the city and maintained by the Chamber of Commerce, the only public recreation areas in Eastport are located at the schools. Children depend on the school playgrounds and athletic fields, backyards, vacant fields and lightly travelled streets for their play areas. A Little League baseball field has been laid out on land owned by the Pittston Company.

Indoor recreation facilities are also almost totally nonexistent in Eastport. The only movie theater closed in the 1960's and the nearest theaters are now in Calais and Machias. Fraternal groups like the VFW organize most of the city's social activities such as dinners and dances. The Rotary Club is also active, sponsoring a six-week program of swimming in the summer and ice skating in the winter for young people. Recreation facilities are local docks and beaches. Because of their abundant forest and water resources, Eastport and Washington County have the potential to expand their tourist trade by developing recreation opportunities. (Current recreational activity is primarily hunting and fishing.) Because of the scarcity of recreational facilities in Eastport, the community's proposed land use plan calls for development of neighborhood parks.

6. Energy Situation (Electric Power)

a. Generation

Development of electrical generation facilities is increasingly reeded in the New England region. The Cobscook Bay area offers the possibility of generating electric power for the region through utilization of daily renewable tidal action. The present study will investigate the integration of this project into the "total" New England power picture. The 1970 National Power Survey forecasted that future annual peak demand requirements for New England would increase from 16,200 megawatts in 1975 to 30,200 megawatts in the 1985 time frame.

More recently, a New England Power Pool (NEPOOL) - NEPLAN report dated 1 January 1978 forecasted that the New England peak load would increase from 15,780 megawatts in the winter of 1978/1979 to 23,440 megawatts in the winter of 1987/1988. Over the next 10 years the regions reserve generation reserve capacity would drop accordingly, from 42 percent to about 23 percent. In the "NEPOOL Forecast for New England for the period 1978-1987" it was indicated that NEPOOL owns or controls facilities which generate approximately 99.6 percent of all electric power in New England. This group performs activities in joint planning, central dispatching, cooperation in environmental matters, coordinated construction, operation and maintenance of electrical generation and transmission facilities and coordination with other power pools and utilities located in the United States and Canada.

NEPOOL's long-range generation planning guidelines, expressed as a percent of total system capability follow:

Type of Generation	% of Capacity
Base Load Capacity (all additions to be nuclear)	56 - 62
Intermediate Cycling Units (fossil fired)	16 - 20
Hydroelectric Peaking, Pumped Storage	8 - 11
Internal Combustion Peaking	9 - 12

The current generation mix for the winter of 1977/1978 and the projected generation mix for the 1987/1988 winter as reflected by NEPOOL authorized additions follow:

	1977/1978			1987/1988		
	MW		%	MW		%
BASE LOAD						
Conv. Steam	2727			2727		
Nuclear	4182			10012		
Subtotal		6909	31.8		12739	44.1
INTERMEDIATE CYCLING						
Conv. Steam & Comb. Cycle		9588	44.0		11121	38.5
HYDROELECTRIC PEAKING						
Conv. & Pumped Hydro		2906	13.4		2916	10.1
INTERNAL COMBUSTION PEAKING						
Gas Turbines & Diesels		1740	8.0		1899	6.6
FIRM PURCHASES						
Net Purchases - Sales		601	2.8		210	0.7
TOTAL CAPACITY		21744	100.0		28885	100.0

ESTIMATED FUTURE LOAD GROWTH

YEAR	WINTER PEAK LOAD (MW)	YEAR	ANNUAL ENERGY (GWh)	LOAD FACTOR %
1978/79	15,780	1978	83,628	60.5
1985/86	21,480	1985	114,625	60.9
1990/91	29,751	1990	163,142	62.7
1995/96	38,334	1995	213,220	63.6
2000/01	49,392	2000	278,671	64.5

The electrical utility industry noted in the 1975 New England Statistical Bulletin that the net energy generated in the State of Maine, where the project would be located, was 7.6 billion kilowatt-hours and the total energy sales to ultimate customers in Maine was 6.328 billion kilowatt-hours. Furthermore, in 1976 the Maine Office of Energy Resources prepared a report, the "Maine Comprehensive Energy Plan - 1976," that evaluated the overall energy situation in the State and made some energy projections through 1985. It stated that Maine's Electrical generating capacity in 1974 consisted of 1290 megawatts in-state and 70 megawatts owned out-of-state for a total of 1360 megawatts and the report contained these projections for electricity consumption, less industrial hydro facilities:

	1980	1985
Low	8,582 GWH	9,872 GWH
Business as Usual	9,519 GWH	10,916 GWH
Full Recovery	10,996 GWH	13,785 GWH

b. Transmission

The regions major electrical transmission network is part of the NEPOOL system and consists of 230 and 345 KV transmisssion lines. This New England grid is interconnected to the rest of the United States through 230 and 345 KV lines. A 345 KV tie line from Maine to New Brunswick connects New England to Canada. The region has requested 345 KV lines to satisfy these general criteria:

1. To provide transmission capacity to deliver output of new generation to the transmission grid.

2. To fulfill the need to supply power to load growth areas; and

3. To maintain system reliability standards throughout the expanding transmission system.

If the tidal power project is constructed, new transmission lines would be required to transmit electrical power from the project which is in the vicinity of Eastport, Maine, to the nearest feasible point of connection to the existing transmission grid. This would result in benefits such as reserve sharing, economy interchange and mutual assistance during emergencies.

c. Institutional Arrangements

(1) General

During the planning of the tidal power project the existing institutional arrangements concerning plant construction, generation, transmission and sale and rate sturctures of electrical

TABLE NO. 12

EXHIBIT XI

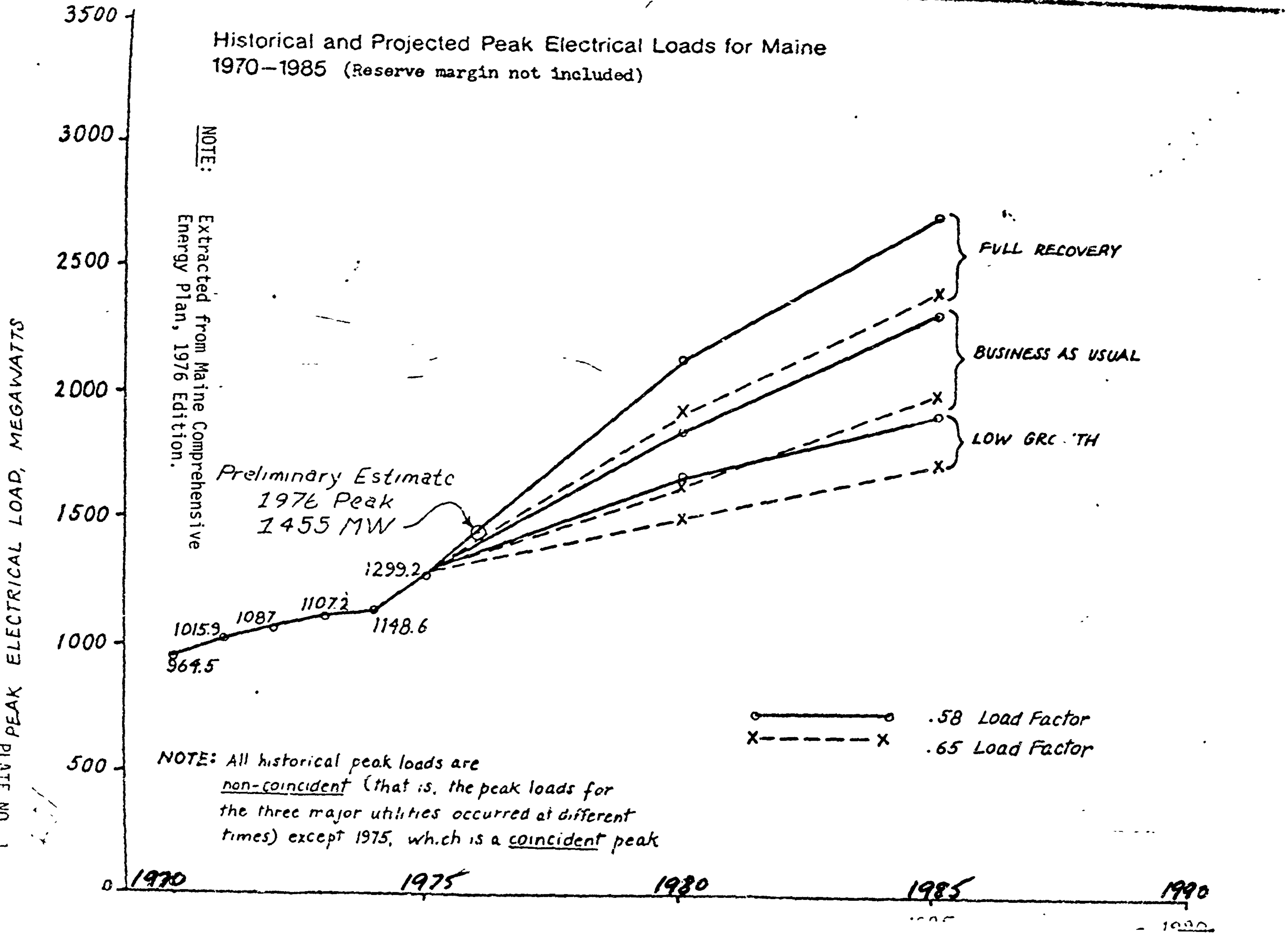
AUTHORIZED ADDITIONS TO NEW ENGLAND GENERATING CAPACITY

(January 1978 through December 1987)

COMPANY	STATION	UNIT	TYPE	FUEL	NOMINAL CAPABILITY - MW SUMMER	NOMINAL CAPABILITY - MW WINTER	EXPECTED OPERATION MONTH	EXPECTED OPERATION YEAR
Central Maine Pwr. Co.	W.F.Wyman	#4	Conv.Thermal	Oil	600.0	600.0	Dec.	1978
Central Maine Pwr. Co.	Brunswick/Topsham	#1	Hydro	-	12.0	12.0	Nov.	1981
Mass. Municipals	Stony Brook	#1	Comb. Cycle	Oil	300.0	340.0	Nov.	1981
Mass. Municipals	Stony Brook	#2 & #3	Gas Turbine	Oil	124.0	170.0	Nov.	1982
Public Service of N.H.	Seabrook	#1	Nuclear	Nuc.	1150.0	1150.0	Dec.	1982
Public Service of N.H.	Seabrook	#2	Nuclear	Nuc.	1150.0	1150.0	Dec.	1984
Boston Edison Company	Pilgrim	#2	Nuclear	Nuc.	1180.0	1180.0	June	1985
Northeast Utilities	Millstone	#3	Nuclear	Nuc.	1150.0	1150.0	May	1986
Central Maine Pwr. Co.	Sears Island	#1	Conv.Thermal	Coal	568.0	568.0	Nov.	1986
New England Elec. System	NEPCO	#1	Nuclear	Nuc.	1150.0	1150.0	Nov.	1986

NOTE: This table is Exhibit XI in the NEPOOL Forecast of 1 Jan 78

TABLE NO. 11



Historical and Projected Peak Electrical Loads for Maine
1970—1985 (Reserve margin not included)
NOTE: Extracted from Maine Comprehensive Energy Plan, 1976 Edition.
PEAK ELECTRICAL LOAD, MEGAWATTS
3500
3000
2500
2000
1500
1000
500
0
1970
1975
1980
1985
1990
964.5
1015.9
1087
1107.2
1148.6
1299.2
Preliminary Estimate 1976 Peak 1455 MW
FULL RECOVERY
BUSINESS AS USUAL
LOW GRC 'TH
.58 Load Factor
.65 Load Factor
NOTE: All historical peak loads are non-coincident (that is, the peak loads for the three major utilities occurred at different times) except 1975, which is a coincident peak

PLATE NO. 1

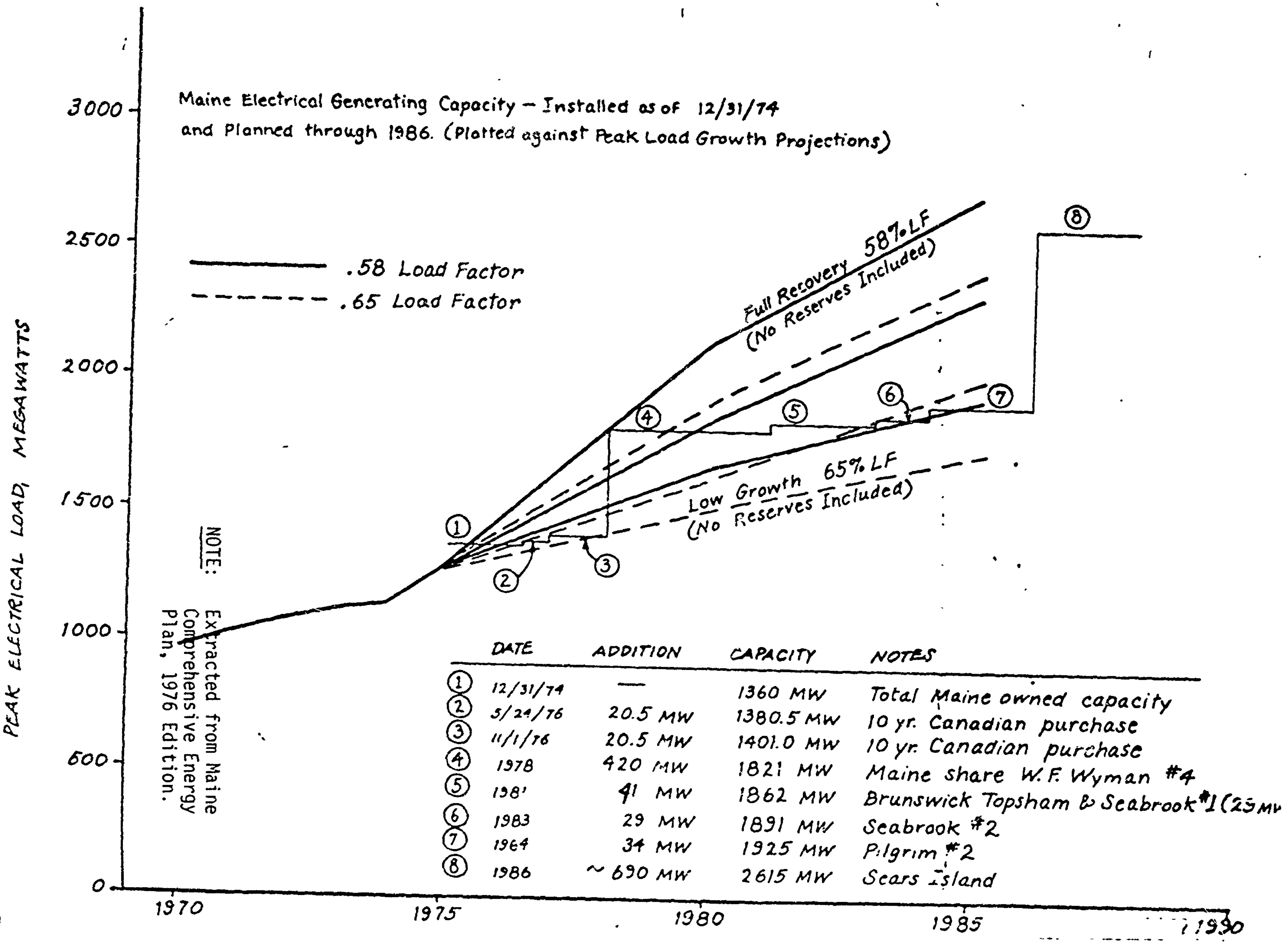
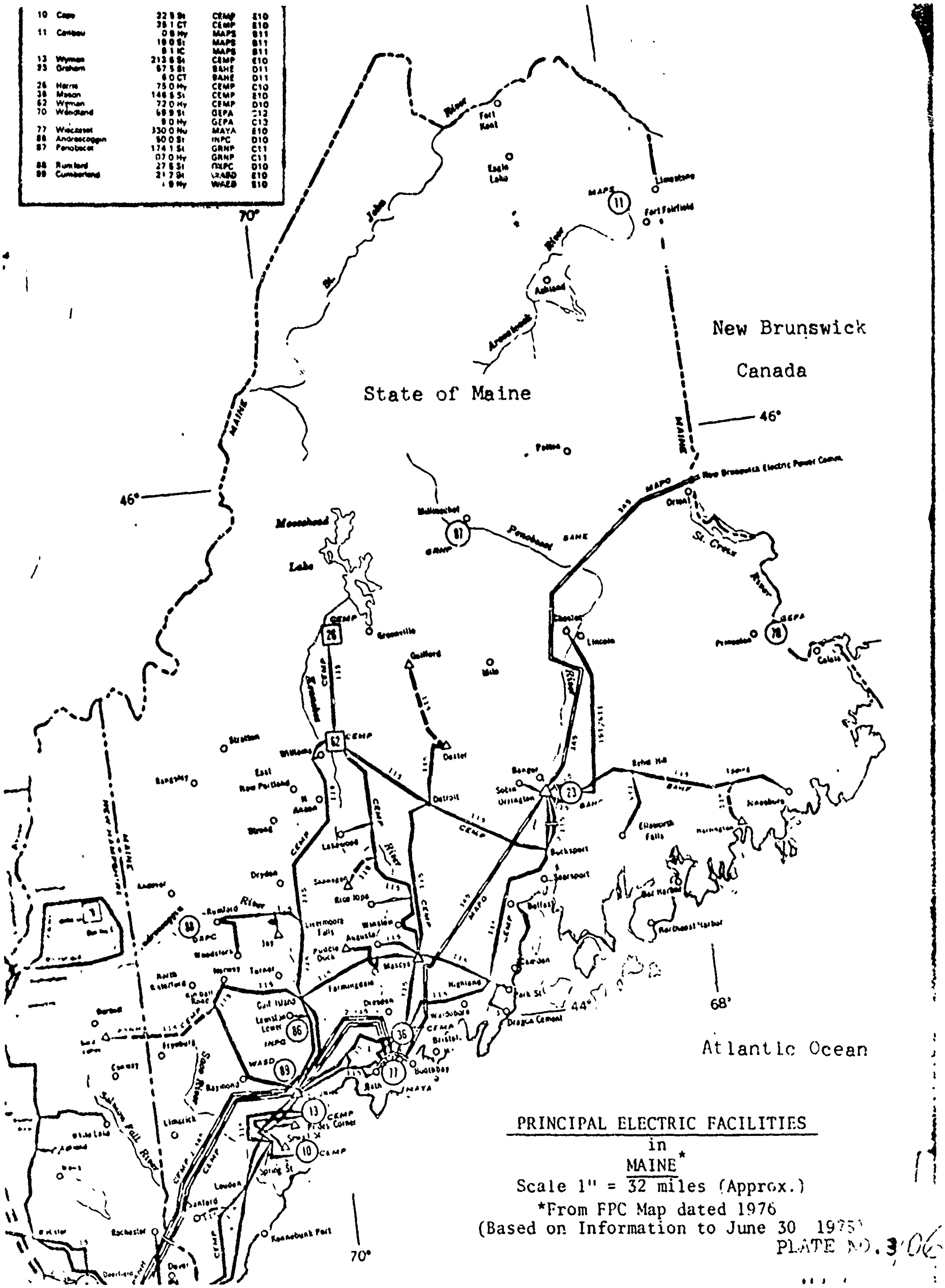

Maine Electrical Generating Capacity – Installed as of 12/31/74
and Planned through 1986. (Plotted against Peak Load Growth Projections)
.58 Load Factor
.65 Load Factor
Full Recovery 58% LF
(No Reserves Included)
Low Growth 65% LF
(No Reserves Included)
PEAK ELECTRICAL LOAD, MEGAWATTS
3000
2500
2000
1500
1000
500
0
1970
1975
1980
1985
1990
NOTE: Extracted from Maine Comprehensive Energy Plan, 1976 Edition.
DATE ADDITION CAPACITY NOTES
① 12/31/74 — 1360 MW Total Maine owned capacity
② 5/24/76 20.5 MW 1380.5 MW 10 yr. Canadian purchase
③ 11/1/76 20.5 MW 1401.0 MW 10 yr. Canadian purchase
④ 1978 420 MW 1821 MW Maine share W.F. Wyman #4
⑤ 1981 41 MW 1862 MW Brunswick Topsham & Seabrook #1 (25 MW
⑥ 1983 29 MW 1891 MW Seabrook #2
⑦ 1964 34 MW 1925 MW Pilgrim #2
⑧ 1986 ~ 690 MW 2615 MW Sears Island

PLATE NO. 2



PRINCIPAL ELECTRIC FACILITIES

in

MAINE*

Scale 1" = 32 miles (Approx.)

*From FPC Map dated 1976

(Based on Information to June 30 1975)

PLATE NO. 3.06

power will be investigated. Investigations will also be made to see what changes or new institutional type arrangements may be necessary, if any, to implement, manage, operate and maintain the tidal power project. The institutional arrangements for electric power are quite complex and specific. The subject is further compounded by the fact that both public and private investments and plants generate electricity for consumption.

(2) Existing Institutional Arrangments

For this plan of study a preliminary review of existing laws, regulations and organizations which influence the electrical energy field has been made to provide an insight to the subject. Following is a general synopsis of the institutional aspect:

(a) Federal Level

- Federal Energy Regulatory Comm. (FERC)

This commission formerly the Federal Power Commission (FPC), regulates the use of hydroelectric power in the United States. The FPC was originally established in 1920 under the Federal Water Power Act.

The licensing of hydroelectric facilities requires a utility to obtain a preliminary permit to investigate a potential hydropower site and also apply for license for reporting the project and for construction, operation and maintenance.

The applicant must provide evidence of compliance with special and applicable State laws for hydroelectric, water quality, etc. Some of the exhibits necessary for review are:

Operation of the project with respect to water use and quality

Recreation plan

Impact on fish and wildlife

Comprehensive development

Utilization of power

Esthetic effects

Environmental impact statement

The FERC has authority over transmission lines between the associated generating plant and the point of interconnection with a utility system. The FERC also has the authority to control interstate transactions dealing with natural gas under provisions of the Natural Gas Act of 1938.

- Department of the Interior (DOI)

Federal hydropower is marketed by the Department of Interior which has five regional power administrations in the United States. Included in their marketing agreements are contracts, rate schedules, accounting practices, metering and records, preference customers energy allocation and point of delivery.

The Bonneville Act requires that a hydroelectric project constructed and operated by the Corps of Engineers deliver its power for sale to the DOI, Bonneville Power Administration.

(b) State Level

The basic State authority for overseeing electric power companies has traditionally been concentrated in the State Public Utilities Commissions. The governmental body was established

to oversee all utilities which provide public services such as telephone, water and transportation as well as electric service.

Other State agencies which exert controls and regulations over power plants and transmission lines include resource departments, fish and wildlife divisions and water pollution control commissions.

In Maine the Environmental Improvement Commission (EIC) is authorized by the 1971 State "Site Location of Development" law to control land use and development of all kinds, including power. Other affected agencies such as Resources, Health and Welfare, State Planning Office, Conservation Commission and Regional Planning agencies must be advised by those applying for power and transmission sitings.

(c) Local Level

As a rule local regulations of power facilities are few, and municipalities must rely upon the Federal and State governments to protect their interests. Most of their control is exercised through zoning boards and safety codes. Other local agencies with possible jurisdiction over a phase or part of a power facility are:

Park Commission	Boards of Architectural Reviews
Department of Airports	Flood Control Districts
Civil Defense	Conservation and Development Comm.
Department of Public Works	

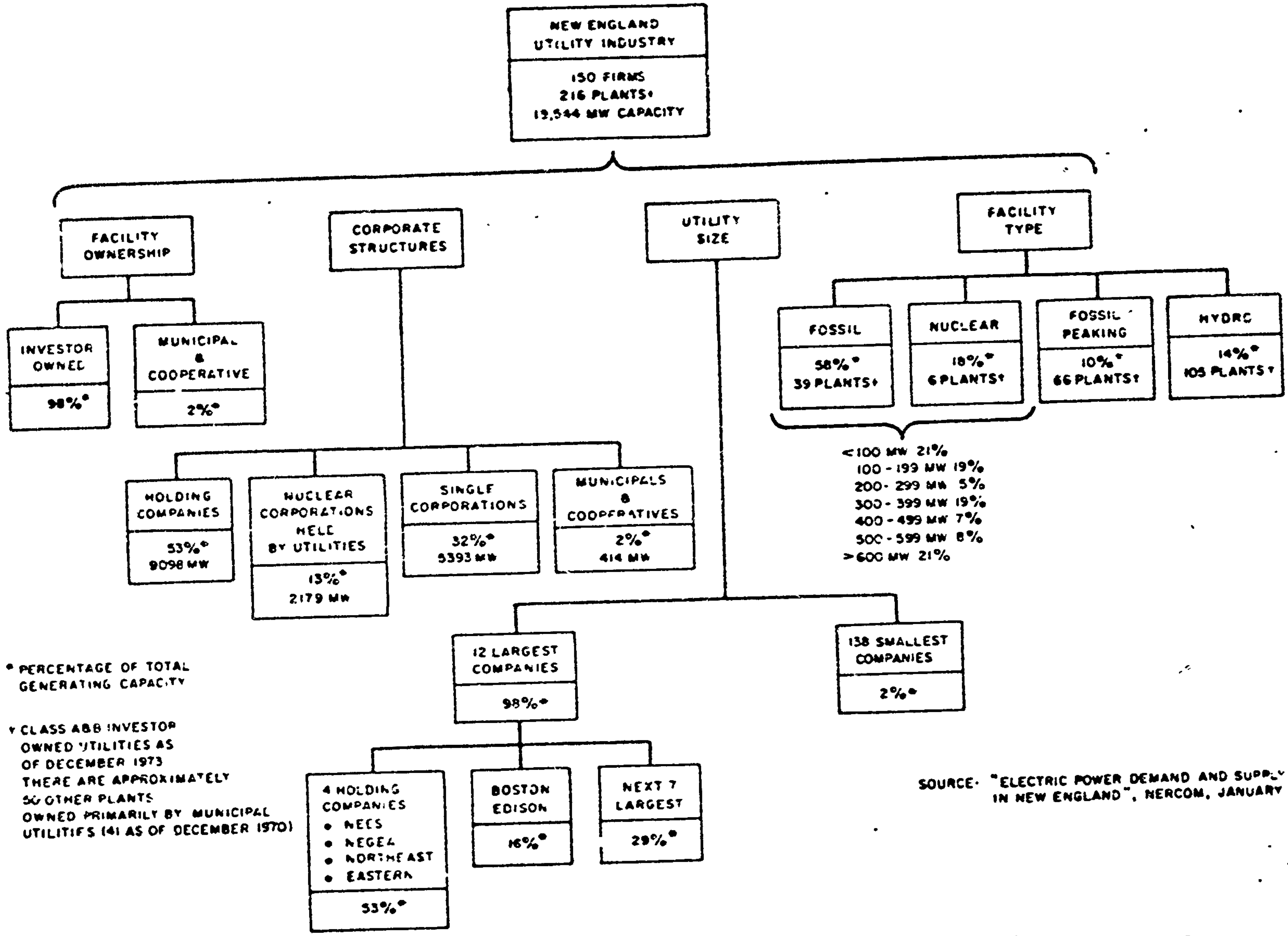
(d) Electrical Industry

The major organization to be contacted and coordinated within the Cobscook Bay Tidal Power Study is the New England Power Pool (NEPOOL). This is an organization of public and private electric utilities that supplies more than 99 percent of the region's electric power. Its operating arm, the New England Power Exchange (NEPEX) coordinates and directs the operation of all major electric power generation and transmission facilities in New England. Its planning arm, New England Power Planning (NEPLAN) accomplishes the planning tasks for the NEPOOL organization and is responsible for forecasting the total demand for the region and defining its growth in total generating capacity.

d. Energy Problems and Needs

Except for wood and water, New England and neighboring maritime Canada possess no natural resources for producing energy and the region relies heavily on imported fuels. Not only does it suffer from the fuel shortage felt by other parts of the United States, its geographic location requires a longer delivery time and higher transportation and storage costs. Alternative sources of energy should be studied to make the region more self-sufficient while preserving the residents environment, health and economic and social well-being.

The New England region also needs to expand its generation capability to meet its future needs. The electrical industry, both public and private, has been planning programs to alleviate

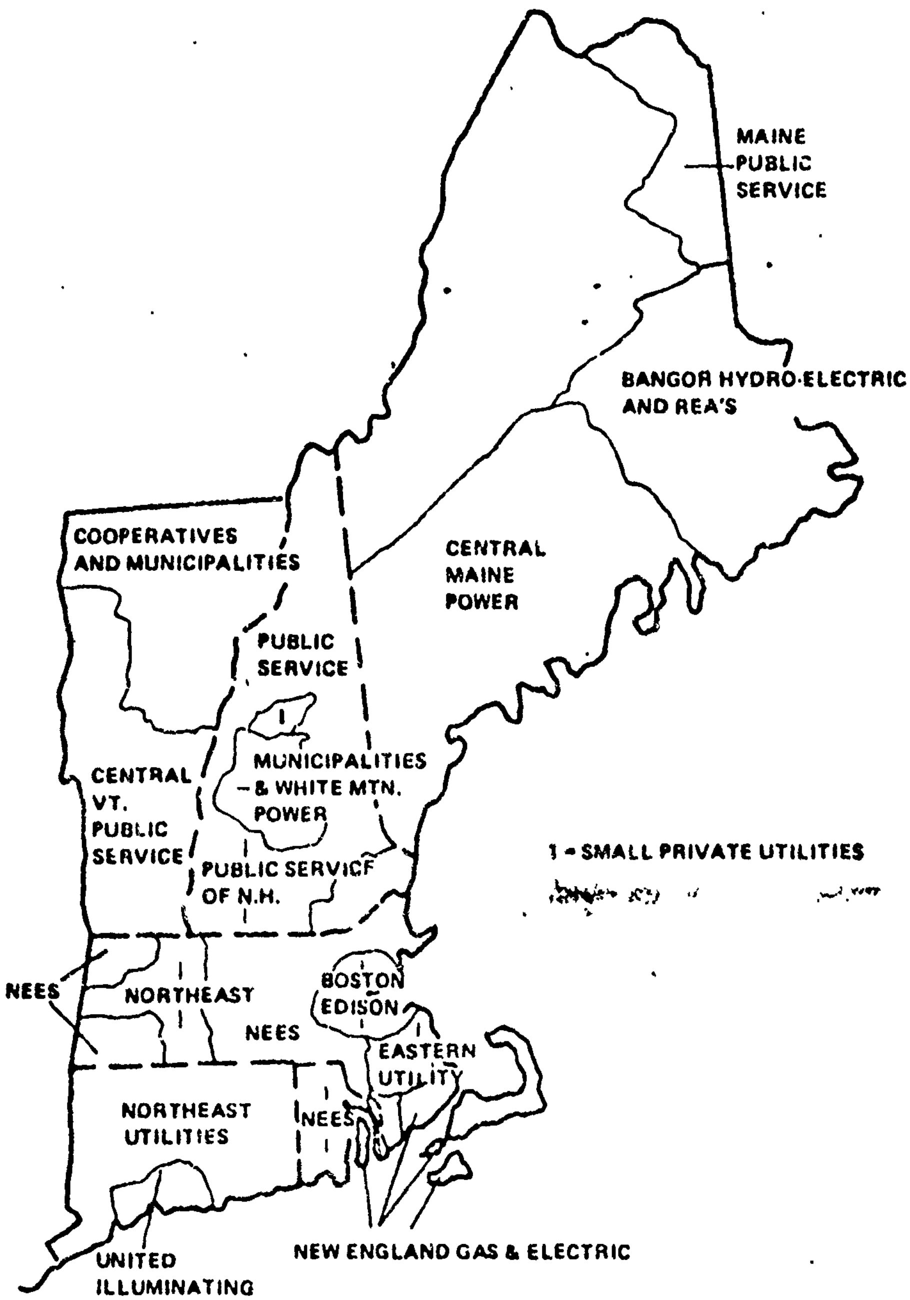


* PERCENTAGE OF TOTAL GENERATING CAPACITY

† CLASS A&B INVESTOR OWNED UTILITIES AS OF DECEMBER 1973
THERE ARE APPROXIMATELY 50 OTHER PLANTS OWNED PRIMARILY BY MUNICIPAL UTILITIES (41 AS OF DECEMBER 1970)

SOURCE: "ELECTRIC POWER DEMAND AND SUPPLY IN NEW ENGLAND", NERCOM, JANUARY 197?

STRUCTURE OF THE NEW ENGLAND UTILITY INDUSTRY



Source: A study of the Electric Power Situation in New England 1970-1990, New England Regional Commission.

Largest Electric Utility Group in New England

PLATE NO. 6

and minimize the situation. With an estimated annual population growth rate of 4.5 percent, it appears that serious electrical supply shortages could occur in the early 1980's, especially if planned generating units continue to face delays. New England's great dependency on oil, especially foreign imports, to generate electric power is also a concern, along with the projected higher costs of oil.

It appears that a tidal power plant in Maine could aid in solving these problems. While such a plant would not be the total energy solution to New England's problem, it would utilize an alternate type of renewable resource, the tides, which is not presently used in the United States. A tidal power plant does not depend on fuels so it would help reduce the dollar drain from the region.

To briefly present the general electrical production and requirements scenario in New England, the following data is also included:

TABLE 13

FORECAST OF TOTAL ELECTRIC POWER CONSUMPTION IN NEW ENGLAND*

YEAR	ANNUAL KILOWATT-HOURS	L.F.
1974	82,787,000,000 (actual)	62.2
1985	183,613,000,000	62.1
2000	363,704,000,000	62.3

* Extracts from NEPLAN, 1 Jan 1977. (See attachments 1 & 2).

NEW ENGLAND SYSTEM CAPABILITY (Winter-Megawatts)**

	1977/1978	1986/1987
Total Capability	29,950MW	30,631MW
Total Peak Load	15,217MW	24,379MW

NEW ENGLAND SYSTEM CAPABILITY (Winter-Megawatts)** (cont'd)

	1977/1978	1986/1987
% Reserve before Maint.	44.2%	25.6%
Est. Peaking Capacity (20%)	4,000MW	6,000MW

** Extracts from NEEPS, July 1973.

According to the Electrical Utility Industry in New England Statistical Bulletin of 1975, the net energy generated in Maine in 1975 was 7,650,000,000 kwh and the total energy sales to ultimate customers in Maine was 6,328,000,000 kwh.

C. Characteristics of a Tidal Power Project

1. General-Harnessing of the Tides

Since the advent of hydroelectric power, numerous tidal power sites throughout the world have been investigated. In addition to the Passamaquoddy/Cobscook Bay area, a few of the locations recently studied for large tidal power plants are the tidal estuary of the River Severn in England, the Bay of L'Aber Vrach northwest of France near St. Malo and the Gulf of San Jose in Argentina. The world's first large scale tidal power plant (240 mw) is now in operation in the La Rance River estuary on the Brittany coast of France. A small 400 kw bulb type generating unit is in operation at Kislaya Guba near Nurmanik, Russia. China has numerous small tidal power projects along its coast.

Tidal hydroelectric power is similar to river hydropower; it can be produced by water flowing from a higher to a lower level through hydraulic turbines. Tidal power has a great advantage over river

hydropower: tides, which can be predicted with accuracy for many years into the future, can produce power unaffected by droughts, floods, ice jams or silting adverse factors which decrease the output and limit the life of river hydroelectric plants. An inherent disadvantage of the tides as a source of power is that the tides, following the gravitational pull of the moon as it passes overhead every 24 hours and 50 minutes, are cut of phase with the 24-hour solar day. This 50-minute daily lag is fundamental to the economics of tidal power. Power output varies with the tides, so tidal power is often completely out of step with the normal use patterns of electricity. The tidal plant could be supplemented by an auxiliary power plant, which might add to its value.

The amount of power generated is governed by tidal ranges, the height between high and low tides, which vary from day to day. As shown in the simplified illustration, the sun and moon appear on the same side of the earth approximately every four weeks at the time of the new moon. Two weeks later, at the time of the full moon, the sun and moon appear on opposite sides of the earth. When either of these conditions occurs, gravitational attraction of the sun and moon reinforce each other and cause maximum or spring tides. When the moon is at either quarter phase, the gravitational attraction of the sun and moon are approximately at right angles with respect to the earth, causing minimum or neap tides.

2. Single Pool Alternatives

A single pool equipped with gates can be built to trap water at high tide and discharge it through turbines to the ocean at low tide, or the pool can be emptied at low tide to receive turbine discharge from the ocean at high tide. A single high pool has the serious disadvantage of producing discontinuous power because no power can be generated without a sufficient difference between the level of the pool and the level of the ocean. Thus, no generation is possible until the ocean has receded sufficiently to obtain this difference in water levels, or power head; nor is generation possible on the rising tide after the level of the ocean becomes too high to provide this minimum necessary head. For similar reasons, a single low pool also produces interrupted power.

3. Two Pool Alternatives

Using two pools, one high and one low, generates varying but continuous amounts of power. This continuous power is achieved in the two-pool plan by operating the emptying and filling gates so that the high pool's level is always sufficiently high than the other's. Cobscook Bay can be segmented into various two or multi pool configurations.

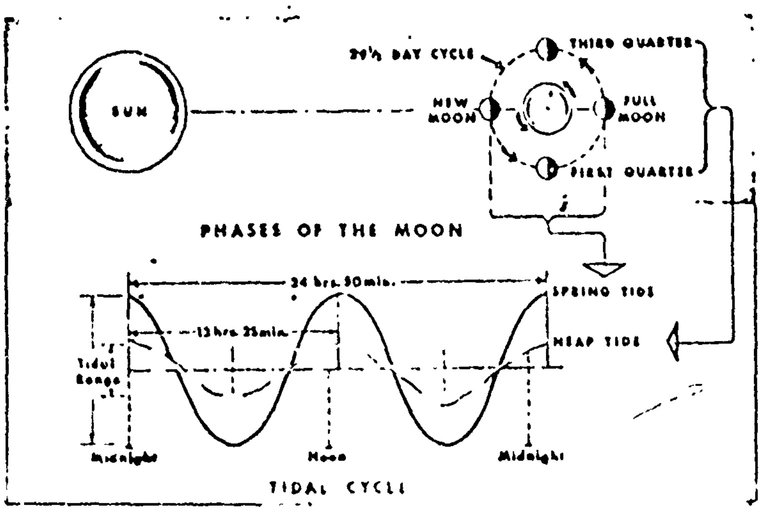
Two pool concepts offer a great deal of flexibility in selecting operation and generation modes. During neap tides "reverse pumping" the water from the low pool up into the high pool would increase the quantity of water available for generating elec-

tricity at more desirable peaking periods. The tidal project could also be used to generate maximum power whenever the tides occur. The capability of one and two way flow type turbines to produce power during in or out going tides will be investigated. Part of the study will be to see how the project will fit into the New England system. It is felt that power produced at Cobscook Bay would be used mostly within the State of Maine.

During the selection of generation mode and power apparatus the following items will be investigated and utilized:

- Projection of Electrical Power Demands
- Demand Characteristics
- Generation Mix of other plants in the region and how the tidal power project will be integrated into the New England system.
- Impacts of Fuels on Energy Policy

When the moon is new or full and simultaneously in perigee -- the point in the moon's orbit closest to earth -- the spring tide is particularly great.



F.GURE NO. 6

The height the tide will reach is also affected, sometimes to a high degree, by the coastline. On open, exposed headlands tides may range from 4 to 5 feet, while in nearly landlocked embayments like the Mediterranean tides are negligible. In the Gulf of Maine which opens toward the deep areas of the Atlantic Ocean as the continental shelf drops off beyond Georges and Browns banks, the tides are greatly amplified by the size and configuration of the shore and bottom. The mean tidal ranges become progressively greater as the tides move into the Gulf of Maine toward the mouth of the Bay of Fundy. The funnel shaped Bay of Fundy again amplifies the tidal range, producing the highest tides in the world at the head of the Bay. Devising a workable and feasible scheme to harness these tides for the economical production of uninterrupted power is the essence of tidal power engineering

D. Description of Possible Tidal Power Projects at Cobscook Bay

1. General

Feasibility of tidal power in the Cobscook Bay where the tides vary between 11.3 and 25.7 feet (average 18.1 feet), has been studied since 1919 by both public and private engineers.

Although the tidal ranges in Cobscook Bay are not as great as at the head of the neighboring Bay of Fundy where spring tides may reach a range of over 50 feet, the lesser tides are offset by

topographical advantages. The peninsulas, islands and passages in Cobscook Bay make possible a wide range of layouts for study and offer many potential locations for emptying and filling gates, navigation locks and powerhouse. It is one of the few tidal power sites in the world where a two-pool plan can also be easily built.

One and two-pool schemes with varying degrees of power production will be studied. In general, each alternative concept would consist of about 3 miles of earth and rock-filled dams in water depths of up to 150 feet, powerhouses with installed capacities between 40 and 250 megawatts and an annual output of electricity between 180 million and 615 million kilowatt hours, filling and emptying gates, navigational locks and support facilities. Using the price levels of 30 June 1976 the construction costs of these different concepts vary from $257 million to $563 million, excluding transmission costs. Transmission facilities will also be investigated during this proposed study.

Power, recreation, fisheries-mariculture and area redevelopment benefits will be provided by this project. Electric power will constitute the major benefit and will provide the revenues for repayment of all costs including interest.

The alternative tidal power projects reevaluated herein for the Reconnaissance Report were previously considered during the 1935-1936 period when President Roosevelt initiated construction of a

tidal power project. All of these projects are completely within the bounderies of the United States, the State of Maine and Cobscook Bay region, and are single and double pool concepts. Additional tidal power alternatives will be investigated during the course of the Survey Scope Study.

The work in reevaluating the projects was accomplished as follows:

Federal Power Commission	Preparing data and providing power values
New England Division	
Engineering Division*	Preparing updated construction cost estimates of All-United States tidal power plans, study management, coordination and report preparation
Planning Division	Area Redevelopment, Recreational and Fisheries Benefits
Real Estate Division	Prepare up-to-date costs for Lands and Damages

* Much of the detailed data for construction cost estimates is based on cost information supplied by the Stone & Webster Engineering Corp. for recent updating of costs for the International Tidal Power Project. The firm was under contract with the New England Division to provide this updated cost data.

2. Brief Description of 1935 era Cobscook Bay Plan

The project selected in 1936 was known as "Plan D" (now alternative 4) and utilized Cobscook Bay as a high pool with the powerhouse discharging water into Western Passage. Although considered in

original plan, pumped storage facilities were not included in the construction of the project.

Three basis alternative plans of development were initially considered. Each plan employed the same general principle involving a single tidal pool and auxiliary pumped storage plant and reservoir or an auxiliary diesel, generator to supply continuous power, but differing in methods of utilization.

Specifically, the plans were:

Alternative 1 - Cobscook Bay developed as a low level pool with one-way flow through the turbines. In this plan, power generation would occur on the incoming tide as soon as the difference in levels between the ocean and low pool exceeded approximately 5½ feet and would continue through the rising and falling tide until the difference in head between the ocean and the low pool again reaches 5½ feet. A pump storage plant was to be located at Hatcock Harbor. Emptying gates would be opened to empty the bay to approximately low tide level. This plan of development contemplated the continued use of Cobscook Bay as a low level pool in the ultimate international two pool project.

Alternative 2 - Cobscook Bay developed as a high level pool with one way flow through the turbines. In this plan, the generation of power would start on the outgoing tide when the head dif-

ferential exceeds 5½ feet and would continue through the low tide and the incoming tide until the difference in level between the high pool and the ocean again reach 5½ feet.

A system of filling gates would be opened to refill the bay to approximately high tide level.

Alternative 3 - Cobscook Bay developed as a high level pool with provision in initial structures for flow in either direction. This plan is similar to plan 2 with the exception that provision is made in initial structures for utilizing Cobscook Bay as either a high or low level pool initially and/or ultimately. The power station would be designed with reversible flow turbines and the filling/emptying gate structures would be designed for flow in either direction.

All plans initially proposed to include 10 generating units with provision for installing 10 additional units at a later date. The units would be 15,000 kw each with a total flow rate of 160,000 cfs. The water wheel generators would operate when the tidal head difference was 5½ feet and above for a period of approximately 7 hours each tidal cycle. The pumped storage plants were to be provided as auxiliary means of power generation to supplement the tidal plant. Subsequently, turbine/generator unit sizes were changed and a flow of 78,000 cfs was determined necessary for the 10 generating units.

The average annual output of power for Alternative 2 was 257,000,000 kwh of continuous power, and increased to 340,000,000 kwh with 100 percent load factor when the pumped storage facility was eliminated, however, power supply was intermittent.

Alternative 2 was recommended for construction on 14 September 1935. However, the project was re-evaluated and various other alternatives were presented. An alternative known as Alternative 4 was finally recommended and approved in May 1936. This plan is basically Alternative 2 with the following major modifications:

a. Deletion of pumped storage facilities at Haycock Harbor.

b. Reducing the number of hydro turbine/generation from 10 to 5 in the tidal power plant.

c. Adding a 30,000 kw diesel auxiliary powrr plant.

d. Reducing the generator sizes from 15,000 kw to 12,500 kw each. The annual electrical production was estimated at 308,000,000 kwh in lieu of the 257,000,000 kwh for Alternative 2.

In 1934 the Dexter Cooper organization endeavored to obtain a loan from the Public Works Administration but the application was disapproved. In the interium, the Maine State Planning Board recommended adoption of the project as a Federal project. Subsequently, an allotment of $10,000,000 was approved by President Franklin D. Roosevelt from the Emergency Relief Appropriation of 1935 for initiation of the project.

3. Description of 1935-1936 Project - Plan D, See Plate 1, Alternative 4

a. Construction Components

POWERHOUSE:

- Five 10,300 Horsepower vertical turbine/generator units each developing 12,500 KW
- TOTAL CAPACITY = 62,500 KW
- 30,000 KW auxiliary diesel power plant
- Provision for future expansion by addition of ten 12,500 KW units

FILLING GATES

- Twelve 30' x 30' venturi gates on Treat Island

NAVIGATION LOCK:

- 56' x 360' x 21' on Treat Island

DAMS:

- Carlow Island (completed - 1,500')
- Pleasant Point (completed - 2,700')
- Eastport (non started - 3,400')
- Treat-Dudley (started but not completed)
- Lubec (not started - 3,800')

b. Power Hydraulics and Energy Production

The project was based on a one-way flow principle of tide-waters passing through the powerhouse from Cobscook Bay into the Western Passage entrance to Passamaquoddy Bay. It was estimated that water flow through each of five turbines would be approximately 7,800 cubic feet

per second at an average head of 12 feet. The total gross energy production was estimated to be 308,000,000 KWH, which included power from the auxiliary plant.

c. Costs

(1) Construction Costs

A breakdown of the total project cost estimates of $37,985,250 is shown below. This estimate is based on 22 May 1936 price levels and include all overheads.

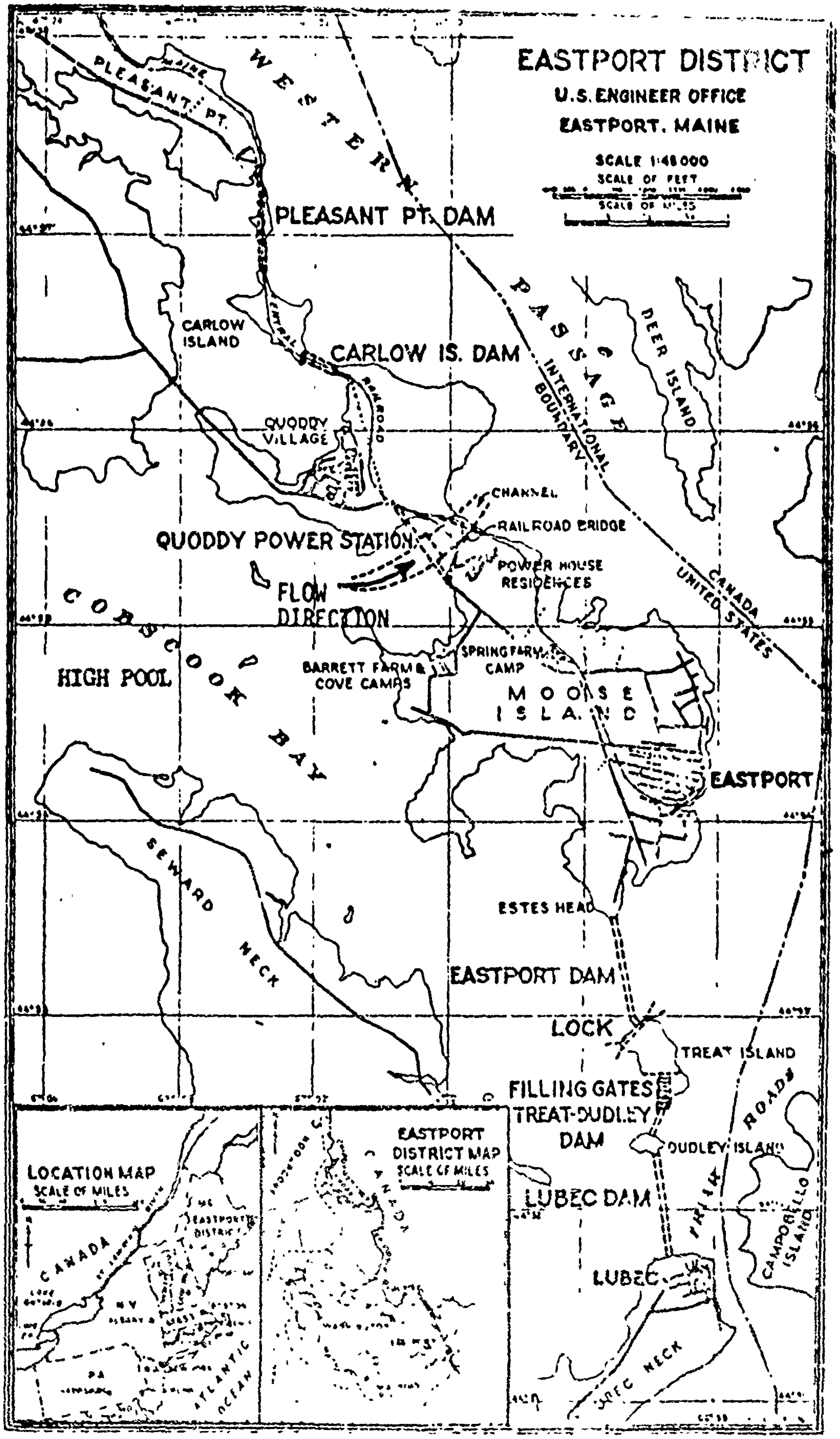
COST ESTIMATE

Cobscook Bay Tidal Power Project (1936)

Item 1	Eastport Dam	$ 8,091,510
Item 2	Lubec Dam	3,967,600
Item 3	Navigation Lock - Treat Island	1,129,700
Item 4	Carlow Island Dam	216,000
Item 5	Pleasant Point Dam	295,100
Item 6	Treat-Dudley Island Dam	334,000
Item 7	Filling Fates (In Treat Island 12 Unit-2/3 capacity with Sill at Elevation-25.0	5,214,900
Item 8	Powerhouse at Carryingplace Cove - 5 Unit . . .	14,868,540
Item 9	Diesel or Stream Auxiliary (30,000 KW)	3,867,900
	TOTAL ESTIMATE	$37,985,250

(2) Annual Charges

The annual charges were estimated to be $2,409,760 for the installation.



PASSAMAQUODDY TIDAL POWER DEVELOPMENT

PLAN D - JAN. 1936

FIGURE NO. 7

d. Two-Pool Systems

Early in 1936, four alternate two-pool plans within Cobscook Bay were investigated and the most economical of the four was submitted with initial and annual costs, power output and benefits. A comparison was also made with single pool Plan D as described earlier. This two-pool plan was designated as Plan 4 (Alternative 8). Two-pool Plan 4 (Alternative 8), shown on Figure 8, consisted of the following features:

1. An inter-pool dam 12,000 feet long from Leighton Point to Razor Island to Seward Neck with a small navigation lock and 5 unit (40 MW) powerhouse.

2. Six 60 foot open-type filling gates and a 1000-foot wide filling channel cut to -30 feet m.s.l. across Seward Neck.

3. Outer-pool dam, 4,200 feet long from Shackford Head to Seward Neck, with six 60 foot open type emptying gates and a 56' x 360' navigation lock.

The three other alternative locations for the dams, locks, and powerhouse that were to divide Cobscook Bay into two pools are summarized as:

Alternative 9 - Inter-pool dam with lock and powerhouse from Leighton Point to Denbow Point and the outer pool dam with lock and emptying gates from Shackford Head to Seward Neck. This plan would also require a dam across South Bay and a filling channel across Seward Neck, and from Federal Harbor into straight bay.

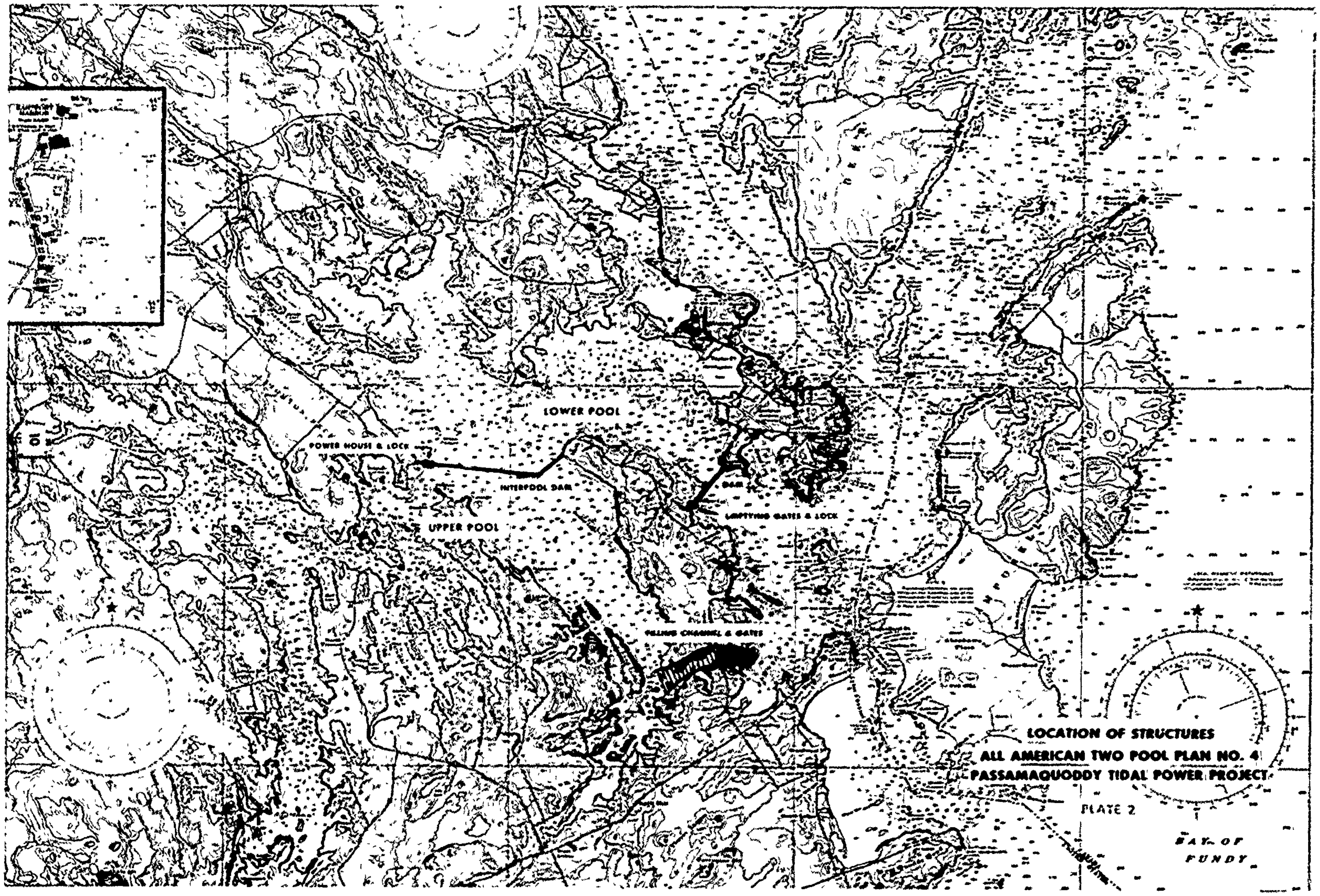

LOWER POOL
POWER HOUSE & LOCK
INTERPOOL DAM
UPPER POOL
DAM
EMPTYING GATES & LOCK
FILLING CHANNEL & GATES
LOCATION OF STRUCTURES
ALL AMERICAN TWO POOL PLAN NO. 4
PASSAMAQUODDY TIDAL POWER PROJECT
PLATE 2
BAY OF
FUNDY
10

FIGURE NO. 8

Alternative 10 - Inter-pool dam with lock and powerhouse from Leighton Point to Seward Neck and the outer pool dam with lock and emptying gates from Estes Head to North Lubec by way to Treat, Dudley and Rogers Islands.

Alternative 11 - Inter-pool dam with lock and powerhouse from Birch Point to Seward Neck with the outer pool dam located as in Alternative 2.

Sketch type layouts of the miscellaneous alternative and plans in Cobscook Bay are shown on the following pages.

In the above plans, including Alternative 8, the inner portion of Cobscook Bay would be utilized as the high level pool. The change in pool area with the change in tidal stage is greater in this portion of Cobscook Bay than the outer part. Also, a substantially greater length of shoreline may be adversely affected if the inner basin were operated at the low pool. Some mud flats may be exposed with low tide basin development.

e. Power Generation (1936 Concept)

In 1936 the plan of power generation was to supply 30,000 kw of power 100 percent of the time. Any output above the 30,000 kw was considered surplus. The diesel auxiliary was to firm power at the site whenever there was insufficient hydraulic head between the upper and lower pools for power generation. Since 1936, however, the concept of auxiliary at-site power went out of date with the formation of the regional system of NEPOOL where the tidal plant would stand strictly on its own.

E. Estimated Project Cost for Selected 1936 Alternatives

1. Construction Cost Estimates

Table 14 shows the total construction cost of selected single and two pool alternatives.

The estimates are based on the following criteria:

- The 1936 project cost, column 1, was tabulated for comparison purposes. Project costs shown in this column were developed by taking the direct government costs of 1936 and adding 23 percent for contractor, overhead and profit. The costs of Carlow Island and Pleasant Point dams were not included since they were already built in 1936.

- Column 2 is a June 1976 cost estimate of the 1936 project (Plan D).

- The tabulated costs, columns 2 through 6, are based on wage rates and material costs as of 30 June 1976. Contractors' overhead and profit of 23 percent are included.

- A contingency factor of 15 percent was utilized for all labor, materials and equipment.

- The tidal power project layout concept is basically the same as the 1936 project.

- The allowance for government costs which cover engineering and design (E&D), supervision, inspection and administration (S&A) during construction has been estimated at 10 percent.

- The construction period for either single or two pool plans with the 5 and 10 unit powerhouse structures were estimated at 3 years, and the 20 unit plan was estimated at 4 years. Alternative 4 in 1936 was scheduled [illegible]mpletion in 4 years.

- Construction methods, equipment and materials proposed in the 1959 International Passamaquoddy Tidal Power Project report and other reports were similar to those that would be used in an All United States Plan today.

- The project is based on a 100-year life.

E. <u>Estimated Project Cost for Selected 1936 Alternatives</u>

1. Construction Cost Estimates

Table 14 shows the total construction cost of selected single and two pool alternatives.

The estimates are based on the following criteria:

- The 1936 project cost, column 1, was tabulated for comparison purposes. Project costs shown in this column were developed by taking the direct government costs of 1936 and adding 23 percent for contractor, overhead and profit. The costs of Carlow Island and Pleasant Point dams were not included since they were already built in 1936.

- Column 2 is a June 1976 cost estimate of the 1936 project (Plan D).

- The tabulated costs, columns 2 through 6, are based on wage rates and material costs as of 30 June 1976. Contractors' overhead and profit of 23 percent are included.

- A contingency factor of 15 percent was utilized for all labor, materials and equipment.

- The tidal power project layout concept is basically the same as the 1936 project.

- The allowance for government costs which cover engineering and design (E&D), supervision, inspection and administration (S&A) during construction has been estimated at 10 percent.

- The construction period for either single or two pool plans with the 5 and 10 unit powerhouse structures were estimated at 3 years, and the 20 unit plan was estimated at 4 years. Alternative 4 in 1936 was scheduled [illegible] mpletion in 4 years.

- Construction methods, equipment and materials proposed in the 1959 International Passamaquoddy Tidal Power Project report and other reports were similar to those that would be used in an All United States Plan today.

- The project is based on a 100-year life.

COBSCOOK BAY TIDAL POWER PROJECT COSTS

Project Features	1936 Project Cost	Alt. 4 5-12,500 KW units with 30,000 KW aux. (1)	Alt. 5 10-12,500 KW units with No aux. (2)	Alt. 6 20-12,500 KW units No aux. (3)	Alt. 7 5-8,000 KW units with 15,000 KW aux. (4)	Alt. 8 5-8,[illegible] KW units No aux. (5)
1. Dams*	10,795,000	40,524,000	33,199,000	31,599,000	45,609,000	45,609,000
2. Navigation Locks	1,028,000	7,962,000	7,962,000	7,962,000	12,500,000	12,500,000
3. Filling & Emptying Gates	4,749,000	40,588,000	40,588,000	57,500,000	32,850,000	32,850,000
4. Power House	14,033,000	98,950,000	175,166,000	334,088,000	74,100,000	74,100,000
5. Auxiliary Power	3,690,000	14,400,000	-	-	7,800,000	-
6. Service Facilities	-	-	880,000	1,000,000	-	-
7. Relocations	-	-	7,144,000	9,619,000	-	-
8. Fishways	-	-	2,000,000	2,000,000	3,000,000	3,000,000
9. Filling Channel	-	-	-	-	28,800,000	28,800,000
10. Sub-Total	34,295,000	202,404,000	266,939,000	443,768,000	204,659,000	196,859,000
11. Contingency 15%	5,144,000	30,361,000	40,040,000	66,565,000	30,699,000	29,529,000
12. Sub-Total	39,439,000	232,765,000	306,979,000	510,333,000	235,358,000	226,388,000
13. E&D and S&A 10%	-	23,276,000	30,698,000	51,033,000	23,536,000	22,639,000
14. Sub-Total	-	256,041,000	337,677,000	561,366,000	258,894,000	249,027,000
15. Real Estate (includes 20% Contingency)	-	1,100,000	1,100,000	1,100,000	1,100,000	1,100,000
16. Service Equipment	-	-	533,000	746,000	-	-
17. Total Construction Cost (First Cost)	39,439,000	257,141,000	339,310,000	563,212,000	259,994,000	250,127,000
18. Interest During Construction	-	24,589,000	32,447,000	71,810,000	24,862,000	23,918,000
19. Total Investment Cost	-	281,730,000	371,757,000	635,022,000	284,856,000	274,045,000

*Pleasant Point and Carlow Island Dams are constructed.

TABLE 14

PROJECT ANNUAL COSTS
(June 1976 Price Levels)

	5-12,500 kw units w/30,000 kw aux. Single Pool (1)	10-12,500 kw units no aux. Single Pool (2)	20-12,500 kw units no aux. Single Pool (3)	5-8,000 kw units w/15,000 kw aux. Two Pool (4)	5-8,000 kw units no aux. Two Pool (5)
Total Investment Cost					
Construction Cost	$257,141,000	$339,310,000	$563,212,000	$259,994,000	$250,127,000
Interest During Construction	24,589,000	32,447,000	71,810,000	24,862,000	23,918,000
Total Investment	$281,730,000	$371,757,000	$635,022,000	$284,856,000	$274,045,000
Annual Costs					
Interest & Amortization	$ 17,997,000	$ 23,748,000	$ 40,565,000	$ 18,197,000	$ 17,506,000
Operation & Maintenance	6,142,000	815,000	1,129,000	3,531,000	718,000
Major Replacements	153,000	324,000	601,000	118,000	95,000
Total Annual Costs	$ 24,292,000	$ 24,887,000	$ 42,295,000	$ 21,846,000	$ 18,319,000

TABLE 15

In addition, other ancilliary benefits from area redevelopment, fisheries-mariculture, and recreation will be derived from construction of the project.

Table paragraphs discuss the anticipated benefits:

TABLE 16

Summary of Benefits

(Preliminary)

Type of Benefits	(1)	(2)	(3)	(4)	(5)
Power	$ 8,123,000	$ 7,693,000	$13,874,000	$ 8,605,000	$ 8,244,000
Area Redevelopment	3,670,000	4,555,000	7,219,000	3,702,000	3,660,000
Fisheries-Mariculture	1,834,000	1,834,000	1,834,000	1,834,000	1,834,000
Recreation	375,000	375,000	375,000	375,000	375,000
Totals	$14,002,000	$14,457,000	$23,302,000	$14,516,000	$14,113,000

2. Discussion of Benefits

a. Power Benefits

The production and sale of electric power would account for the greatest part of the project benefits and should, over a period of time, provide the entire revenue for the project cost repayment, including interest. Annual energy generation quantities were taken from the 1935 to 1937 Passamaquoddy Tidal Power Development Studies which provided a comprehensive scoping of single and two pool tidal arrangements.

Although modes of operation may differ somewhat if the project were to be completely restudied today, it is believed that these figures are appropriate for this report. Table 17 shows the value of tidal power used to compute power benefits. The selection of capac· and energy values for a single pool system were arrived at from the following observations:

Any single pool tidal power plan would provide energy generation as a function of the lunar cycle - and different than that of the solar cycle. The lack of storage generation control causes generation out of phase with electrical load and accordingly, the time availability of energy would vary daily. Generation cannot be relied upon at all time. Consequently, no power would be firm on the load in the traditional sense, and the value of the tidal plant would be limited. Therefore, the tidal plant would have practically no capacity value.

Tidal power generation, on the other hand, would be entirely predictable, renewable, and nearly independent of the climatic variables of a traditional hydropower installation. Scheduling of generation could be best as a "fuel saver," a producer of maximum energy whenever it occurs, allowing those plants with the highest associated fuel costs to shut down when tidal power is available. The value of this intermittent energy would be directly dependent on the generation mix in the NEPOOL system.

Today, the generation mix includes all types of plants - nuclear, oil and coal-fired steam, combined-cycle gas turbines and hydro (conventional and pumped-storage). With the exception of nuclear, it is believed

that, at one time or another, any of the types would be in a position in the New England load to be replaced by tidal power in the NEPOOL system, and therefore, the value of the tidal power as replacement should reflect a conglomerate of all types of system fuel costs. An exact value for this weighted conglomerate cost is difficult to define but a June 1976 price level value for the tidal power of 24 mills ($.024) per kilowatt-hour seems reasonable for this study. This is meant to represent an average cost for all fossil fuel derivative generating types.

The two pool unit values in Table 17 are the same as those used for the 500 MW International Project (10 percent private financing only for benefit-cost consumption). In many respects its operational characteristics could be considered similar to those of the larger International project.

TABLE 17

Cobscook Bay Tidal Power Project

At-Market Unit Power Values
(June 1976)

ITEM	UNIT	UNIT VALUE SINGLE POOL	TWO POOL
Capacity Value*	$/kw/yr	0	45.00
Energy Value	mills/kwh	24.0	24.0

*Single pool systems do not have dependable capacity therefore no capacity value was given.

The following table (Table 18) summarizes the total annual power benefits that would be realized from each plan. Transmission losses of eight percent for capacity and six percent for energy were assumed.

TABLE 18

Cobscook Bay Tidal Power Project
Annual Project Power Benefits
(June 1976 Price Levels)

PLAN	CAPACITY (MW)	Gen. Energy (GWH)	Annual Benefit ($/yr)
(1) Alt. 4 - 5 units & 30,000 kw auxiliary	62.5	305	$ 8,123,000
(2) Alt. 5 - 10 units no auxiliary power	125	341	$ 7,693,000
(3) Alt. 6 - 20 units no auxiliary power	250	615	$13,874,000
(4) Alt. 7-2 pool w/5 units & 15,000 kw auxiliary	40	308	$ 8,605,000
(5) Alt. 8-2 pool w/5 units, no auxiliary power	40	292	$ 8,244,000

b. Recreation Benefits

It is considered that the value of benefits from recreation would be approximately the same for each tidal power projects. The estimated present annual U.S. dollar value is $375,000 based on 300,000 visitor days per year and a daily rate of $1.25 per day. This annual visitation does not appear to be abnormal as it is our understanding that in 1975 the La Rance, France, tidal power project attracted approximately 300,000 tourists.

c. Fisheries-Mariculture Benefits

Cobscook Bay has active fisheries with a total annual value of $1,400,000. With the construction of a tidal power project in Cobscook Bay it is felt that more advantageous conditions would prevail for fishing and development of mariculture practices, although there would be some fisheries losses realized. It is estimated that there would be an annual gain through mariclutire of $3,400,000 and a possible annual fisheries loss of $1,666,000 for a net benefit of $1,834,000. It is considered that this annual dollar benefit would apply to any of the five alternative tidal projects considered.

d. Area Redevelopment

Assumptions for estimating the AR benefits are based on construction cost plus contingencies, that local labor will be 75 percent of the total labor cost (27 percent) of the total project cost, 3 year construction period (4 years for plan with 20 unit powerhouse), a 6-3/8 percent interest rate, and applicable operation, maintenance and replacement costs.

The following table presents the estimated Area Redevelopment benefits for each plan:

TABLE 19

ESTIMATED ANNUAL AREA REDEVELOPMENT BENEFITS

	PLAN (1)	(2)	(3)	(4)	(5)
Area Redevelopment	$3,670,000	$4,555,000	$7,219,000	$3,702,000	$3,660,000

G. Benefit to Cost Ratio

This section of the report summarizes the project economics with the benefit to cost ratio method of analysis.

The benefit-cost ratio results from a comparision of all project annual benefits of power, recreation, area redevelopment and fisheries-mariculture with total project annual costs. Annual costs include interest and amortization (6-3/8% and 100-year repayment period), operation and maintenance and major equipment replacements. The results of the above figures expressed as a quotient indicates the relative merits of a project.

Table 20 summarizes the benefit-cost ratio computations for the five plans and all are below unity. However, a comparison of B/C ratios clearly shows which are closer to unity, therefore, more economical with this method of analysis.

H. Life-Cycle Analysis

Due to the energy situation and rising cost of fossil fuel generating alternatives, Governor Longley (see Attachment 1) suggested the feasibility of tidal power be re-evaluated.

In response to the Governor's request dated September 7, 1976, the Corps performed a preliminary life-cycle cost analysis on the international Passamaquoddy tidal power project. Life-cycle cost analysis is an economic method which considers rising prices in determining future energy costs. A preliminary life-cycle cost

COBSCOOK BAY TIDAL POWER PROJECT
ALL AMERICAN PLANS
BENEFIT-COST RATIO ANALYSIS

	Alt. 4 5 - 12,500 KW generators with 30,000 KW aux. (1)	Alt. 5 10 - 12,500 KW generators w/o aux. power (2)	Alt. 6 20 - 12,500 KW generators w/o aux. power (3)	Alt. 7 2 pool w/5 8,000 KW generators & 15,000 KW aux. (4)	Alt. 8 2 pool w/5 8,000 KW generators w/o aux. gen. (5)
Total Investment Cost	$281,730,000	$371,757,000	$635,022,000	$284,856,000	$274,045,000
Capacity MW	62.5	125	250	40	40
KWH/yr*	305,000,000	341,000,000	615,000,000	308,000,000	292,000,000
Total Annual Benefits	14,002,000	14,457,000	23,302,000	14,516,000	14,113,000
Annual Power Benefits**	8,123,000	7,693,000	13,874,000	8,605,000	8,244,000
Total Annual Costs	24,292,000	24,887,000	42,295,000	21,846,000	18,319,000
Total Annual Benefits / Total Annual Cost	0.58	0.58	0.55	0.66	0.77
Annual Power Benefits / Total Annual Cost	0.33	0.31	0.33	0.39	0.45
Total Investment Cost / KW	$ 4,508	$ 2,974	$ 2,540	$ 7,121	$ 6,251

*Net Annual Salable Energy

**Includes Transmission Losses of 8% for Capacity (where applicable) and 6% for Energy.

TABLE NO. 20

analysis was prepared by ERDA for one of the Cobscook Bay alternatives. A new "life-cycle" cost study will be performed as part of a future study.

In accomplishing "life-cycle" costing, a computer model was utilized as described in Chapter VI of U. S. Department of Commerce, National Technical Information Service Report AD/A-018 dated July 1975, titled "Hydroelectric Power Potential at Corps of Engineers Projects".

On 29 November 1976, the New England Division confirmed the request for the Federal Power Commission, New York Regional Office, to furnish the necessary expertise and to accomplish the life-cycle cost study by utilizing the computer model in their Washington office. On 12 January 1977, FPC-NED conference was held in the FPC offices in New York to review the proposed work and to discuss input parameters and variables incorporated in the study.

In applying the computer model, the 500 MW international tidal power project was compared to its most probable alternative, a combined cycle plant. Annual escalation rates of 3, 5, and 7 percent were selected to reflect a range of increases in costs for items subject to rise in areas of labor, materials, replacements and fuel during the operation and maintenance period.

Annual costs such as amortization, depreciation and interest on investment remain constant. The sharp jumps in the curves representing the thermal alternative (Fig. 9 through 11) result from fixed depreciation charges based on earlier lower costs which are

inadequate in terms of replacing the worn-out plant and equipment. To compensate for this effect, the actual costs of replacement have been escalated and compounded annually for each 30 year major replacement interval for the thermal alternative.

Based on a 100 year project life and assuming that the 500 megawatt international Passamaquoddy tidal power project went on line in June 1976 with annual costs of $121,121,000 for producing 1,932,000,000 kwh/year, Figures 9, 10, & 11 show the projected annual costs based on annual compounded escalation rates of 3, 5 and 7 percent. For comparison purposes, both the alternative and tidal power projects are financed at 5 3/8 percent. The charts also show the estimated annual benefits from tidal power produced by the project, starting with $55,316,000 in June 1976. In escalating the power benefits at similar rates, the annual benefits will increase faster than the annual costs of the tidal power plant. The principal reason the benefits (costs of alternative) ultimately surpass the annual costs for the tidal project is because tidal power does not rely on a fuel for generating electricity as does the alternative combined cycle plant.

Line projections for annual power benefits and costs intersect after a period of project operation and the benefit/cost ratio becomes 1.0 to 1.0 at the intersection and increases each year thereafter. The following indicates the year that the B/C ratio equals 1.0:

Escalation Rate	Year BCR = 1.0
3%	31
5%	20
7%	15

From the data used to produce plates 1 through 3, the total present worth and annual cost were computed and tabulated in Table 2. The last column in Table 21 shows how the benefit/cost ratio, based on power benefits only, is affected by various rates of escalation. The higher the rate of escalation, the larger the B/C ratio.

Although life-cycle costing was not accomplished herein for any of the United States Plan, the results would be similar from a life-cycle analysis viewpoint.

The preliminary life-cycle costing study contained herein is based principally on general inflationary trends. As more detailed life-cycle analysis is undertaken during future studies, only relative price shifts will be considered.

The focus on real price relationships, net of general inflation is important. The basic rationale for this approach is as follows: the monetary value of any good is ultimatlet valued in reference to other goods (goods refer to all things of value - i.e., wages, material goods) available in the market place. If all goods inflated at the same rate, then ostensibly their value would not be altered. By concentrating on relative price changes, we are considering fundamental changes in the valuation of that good.

(In reality, however, inflation is not so evenhanded, since many things, i.e., fixed pensions, debts, are not altered by inflation. Thus, there is distortion involved in the valuation of certain goods).

In addition, future studies will need to discuss potential substitution affects.

The escalation rates utilized above imply a fairly high cost of fuel as an input for the alternative. The table below lists the percentage increase in the price of oil relative to today's price for the different escalation rates utilized.

Percentage of Escalation Rate	Percentage Increase in Fuel Price in Year that the BCR = 1.0	Percentage Increase in Fuel Price 100 Years From Now
3	150	226
5	165	604
7	176	1397

Long run increases in the relative price of fossil fuels would tend to be dampened by three major factors. One, as the relative prices of fossil fuels incrase, prices would be reached at which existing technologies - i.e., shale oil recovery, would become economically feasible. In a market economy, a substitution effect would occur and the demand for fossil fuel as energy inputs would be transferred to other forms of energy. With demand reduced, given a competitive marketing economy (this would be approached given a long enough time period), price increases would be slow.

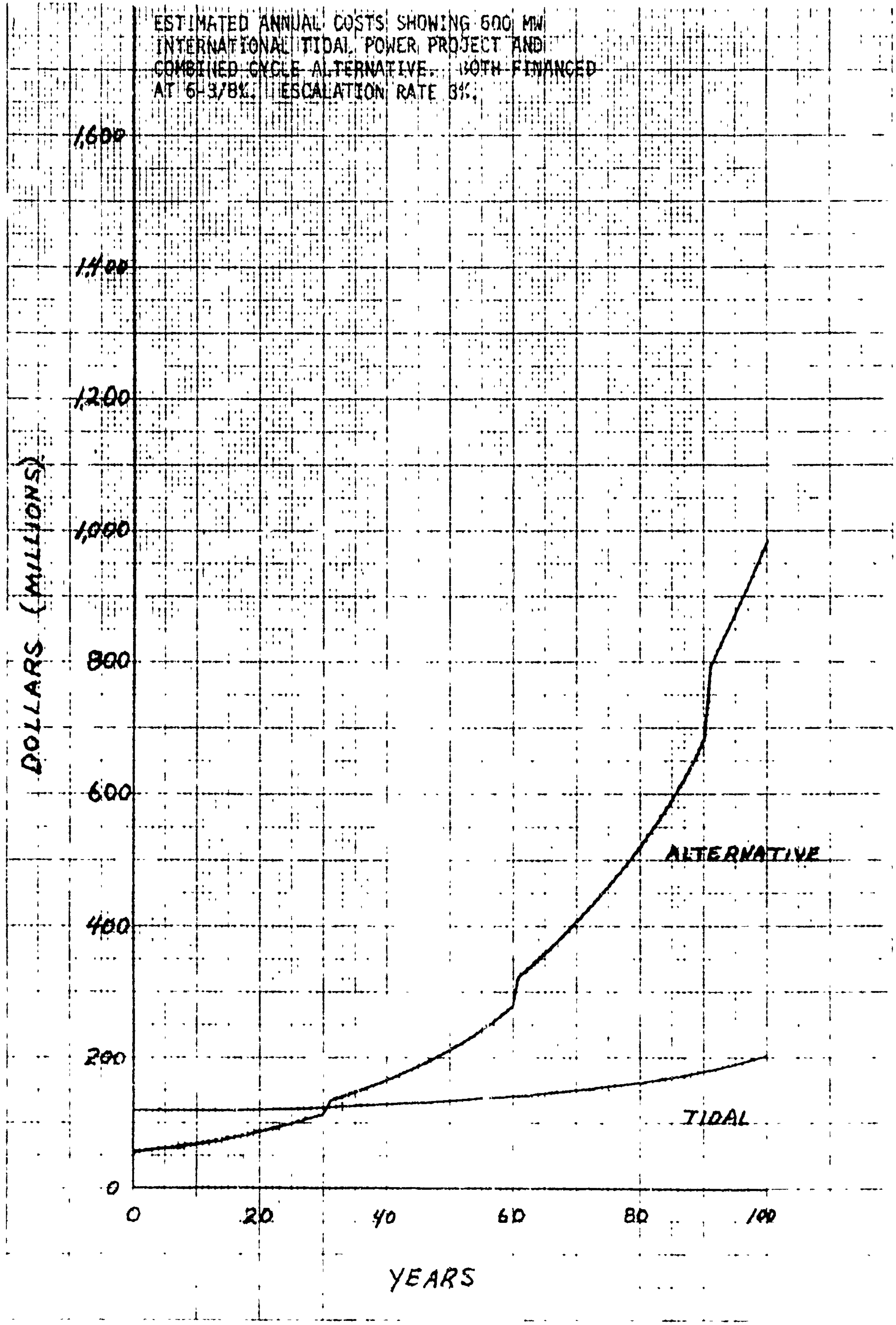

ESTIMATED ANNUAL COSTS SHOWING 600 MW
INTERNATIONAL TIDAL POWER PROJECT AND
COMBINED CYCLE ALTERNATIVE. BOTH FINANCED
AT 6-3/8%. ESCALATION RATE 8%.
DOLLARS (MILLIONS)
1,600
1,400
1,200
1,000
800
600
400
200
0
ALTERNATIVE
TIDAL
0
20
40
60
80
100
YEARS

FIGURE NO. 9

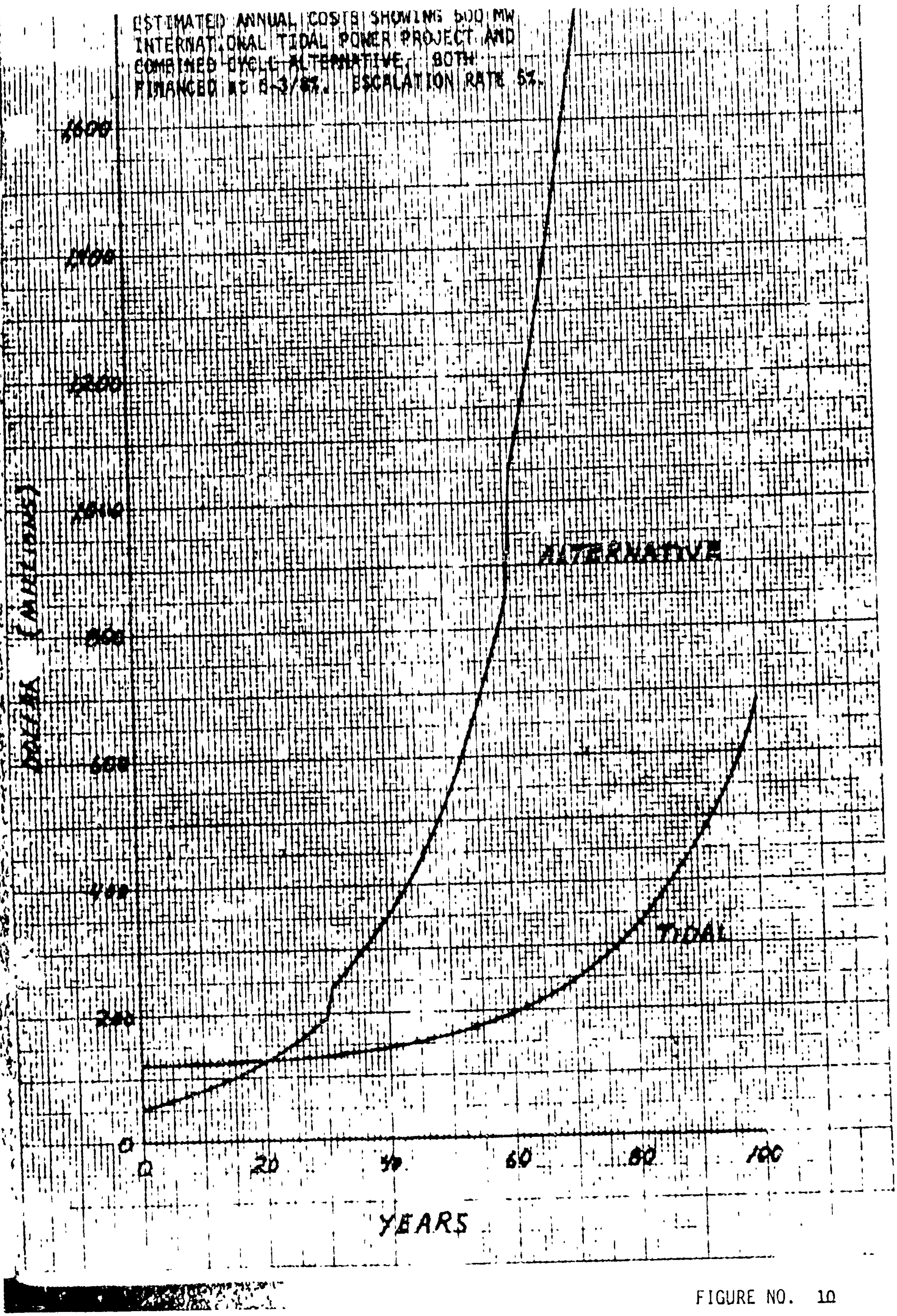

ESTIMATED ANNUAL COSTS SHOWING 500 MW
INTERNATIONAL TIDAL POWER PROJECT AND
COMBINED CYCLE ALTERNATIVE. BOTH
FINANCED AT 8-3/8%. ESCALATION RATE 5%.
ALTERNATIVE
TIDAL
YEARS
0
20
40
60
80
100
200
400
600
800
1000
1200
1400
1600

FIGURE NO. 10

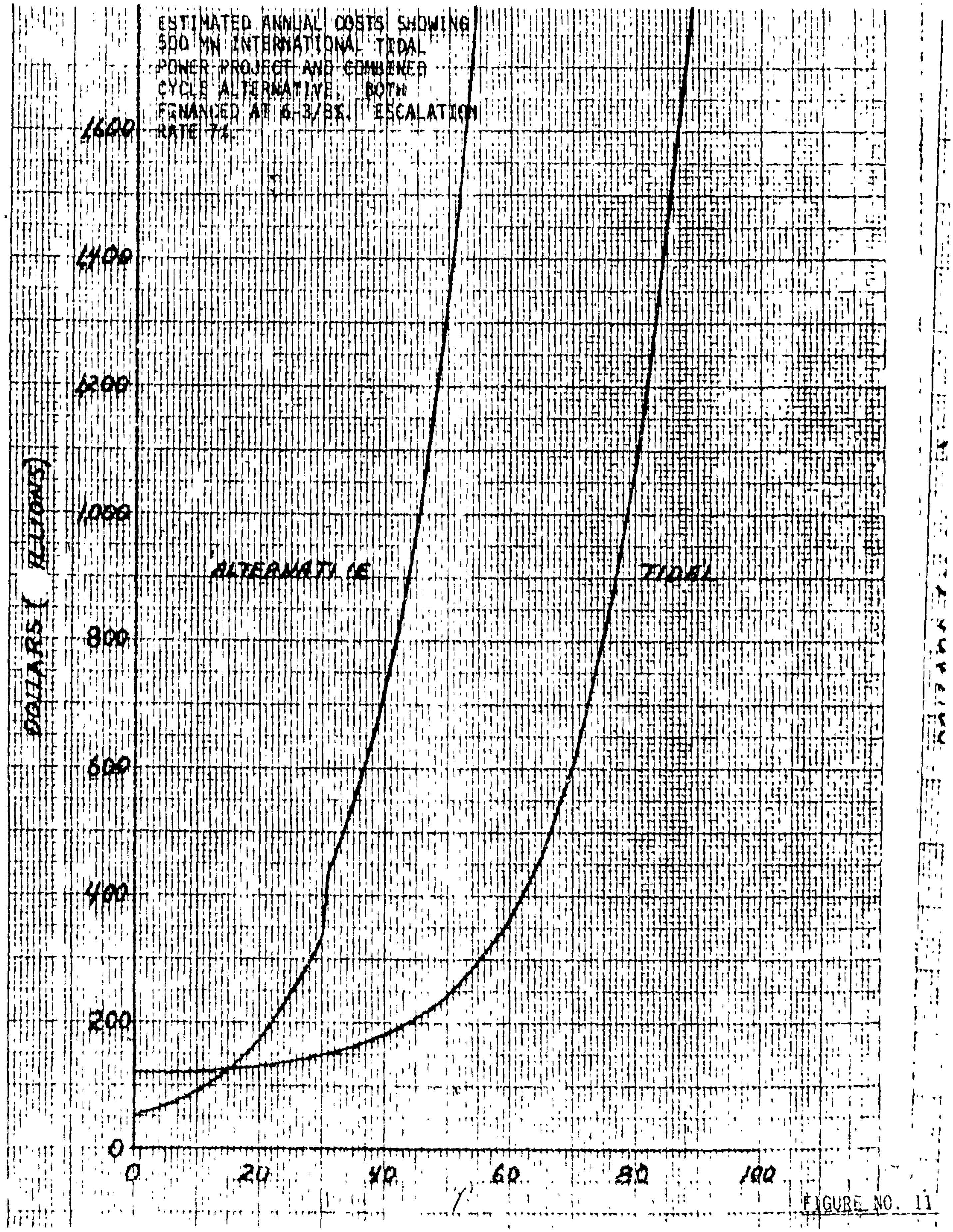

ESTIMATED ANNUAL COSTS SHOWING 500 MW INTERNATIONAL TIDAL POWER PROJECT AND COMBINED CYCLE ALTERNATIVE. BOTH FINANCED AT 6-3/8%. ESCALATION RATE 7%
DOLLARS (MILLIONS)
1600
1400
1200
1000
800
600
400
200
0
0
20
40
60
80
100
ALTERNATIVE
TIDAL

FIGURE NO. 11

TABLE 21

Life-Cycle Analysis of
500 MW International Tidal Power Project
(Both Plants Financed at 6-3/8%)

Interstate	Escalation Rate	Plant Type	Total Present Worth (6-3/8% Discount Rate)	Annual Cost (Using CRF 100 Yrs. 6-3/8%)	Levelized Cost (Mills/ KWH)	Life Cycle B/C Ratio (Power Benefits)
6-3/8%	3%	Alternative	$1,491,753,000	$ 95,294,000	49.3	.76
6-3/8%	3%	Tidal	1,958,832,000	125,130,000	64.8	
6-3/8%	5%	Alternative	2,731,104,000	174,463,000	90.3	1.32
6-3/8%	5%	Tidal	2,072,210,000	132,373,000	68.5	
6-3/8%	7%	Alternative	6,531,940,000	417,260,000	216.0	2.70
6-3/8%	7%	Tidal	2,420,867,000	154,645,000	80.0	

Two, over time, new technologies for energy production - i.e., fusion power, would become available. These forms of energy power would become economically feasible at a certain price and then would dampen further price rises among fossil fuels. Three, as the price of energy production rises relative to other goods, the rate of growth in the demand for all energy forms would be reduced. This would alleviate some of the upward pressure on prices.

Because of these considerations, the analysis presented should be viewed with a great deal of caution.

I. The Other Proposed Projects

Currently, two other projects have been proposed for the Cobscook Bay/Passamaquoddy areas, one being the Passamaquoddy Indian Tribal Tidal Project, at Half Moon Cove, Maine. (See Figure No. 12)

This current proposal involves a small tidal power project in the vicinity of Half Moon Cove (near Bar Harbor and adjacent to Quoddy Village) in the northerly portion of Cobscook Bay. The plant would produce 5 to 12 megawatts at a total estimated cost of approximately 9 million to 15 million dollars. The exact plant size has not been determined.

The Pleasant Point Tribal Council is attempting to obtain a grant from the Federal Energy Regulatory Commission and Department of Energy. In the event that both the Tribal Council and the Federal Government build tidal projects in the Bay, close coordination will be required for successful planning, construction, and operation of the projects.

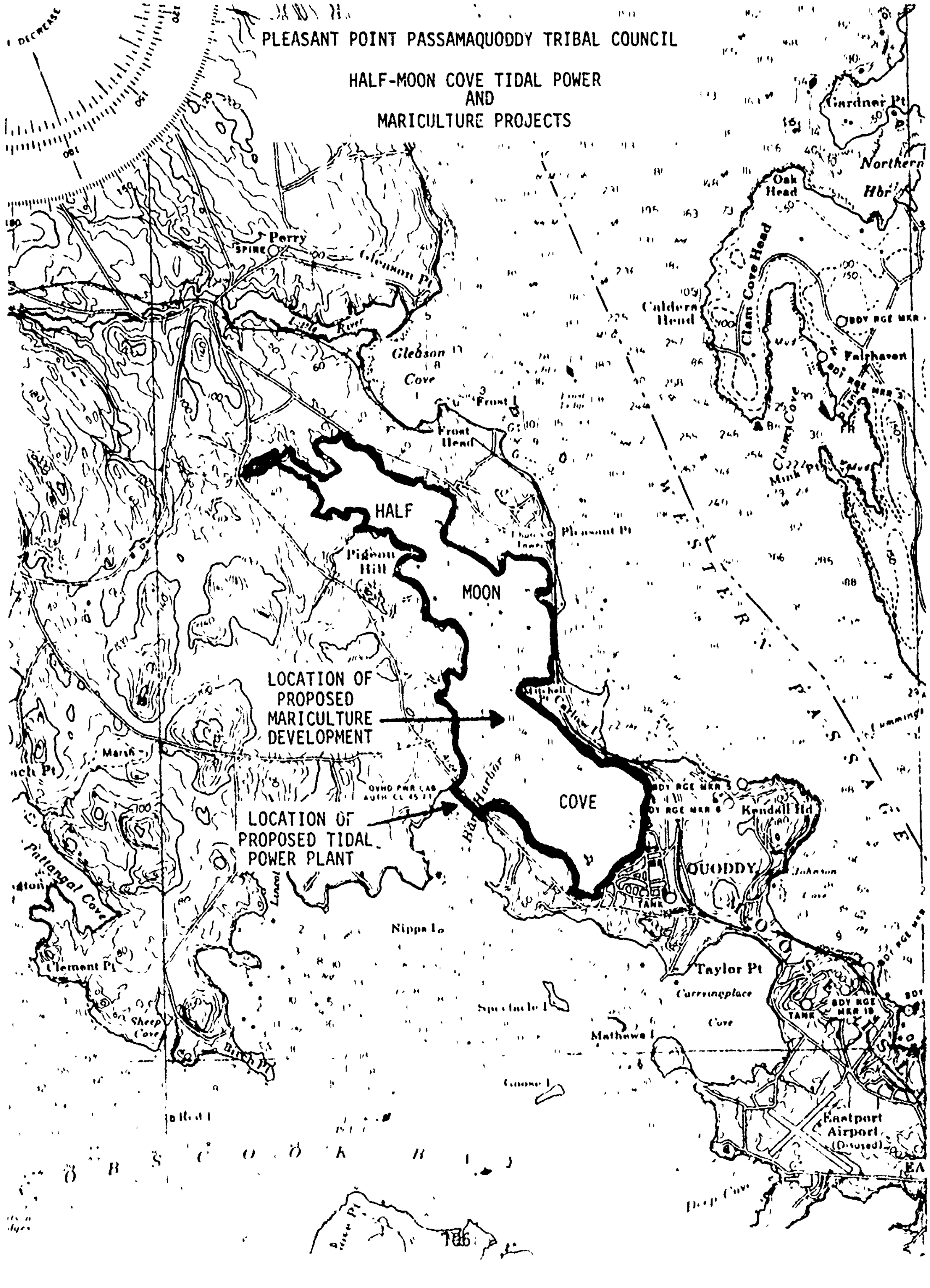

PLEASANT POINT PASSAMAQUODDY TRIBAL COUNCIL
HALF-MOON COVE TIDAL POWER
AND
MARICULTURE PROJECTS
HALF
MOON
COVE
LOCATION OF
PROPOSED
MARICULTURE
DEVELOPMENT
LOCATION OF
PROPOSED TIDAL
POWER PLANT
Perry
Gleason Pt
Gleason Cove
Front Head
Pigeon Hill
Pleasant Pt
Calderra Head
Clam Cove Head
Oak Head
Gardner Pt
Northern Hbr
Fairhaven
Mink Pt
Kendall Hd
QUODDY
Taylor Pt
Carryingplace Cove
Nipps Is
Spectacle I
Mathews I
Goose I
Clement Pt
Sheep Cove
Birch Pt
Pattangal Cove
Eastport Airport (Disused)
Deep Cove

FIGURE NO. 12

The other major project is a proposed 250,000 (and per/day refinery and deepwater marine terminal at Eastport). The Pittston Company of New York is currently planning the facility. Information regarding this project can be found in a report dated 8 March 1976 titled, "An Environmental Assessment Report" and a final environmental impact statement dated June 1978. The project has not yet received all approvals.

If the tidal power project is authorized and constructed and the refinery is built, then there would have to be operational and waterbourne navigational coordination to facilitate shipment of Pittston's crude and finished projects. The water transport route to and from the refinery, as well as the associated docking facilities, would be affected by the locations of dams and the size of the navigation locks in the alternatives under consideration.

The basic tidal power project includes construction of a 415' x 60' x 21' navigation lock. If the use of 70,000 DWT tankers is permitted, the navigation lock would have to be increased in size from 415' x 60' x 21' draft to approximately 830' x 120' x 42' draft, hence, increasing the initial construction and total investment costs and annual charges while lowering the benefity/cost ratio for the overall tidal power project.

Similar charges would occur if 250,000 DWT tankers are allowed through the transport route, requiring the navigation lock to be increased in size from 415' x 60' x 21' draft to approximately 1250' x 180' x 67'.

Representatives of the New England Division and the Pittston Company have discussed overall siting conflicts and have prepared a revised layout sketch in which the siting of the refinery corresponds with tidal power projects and associated facilities. (See Figure 13)

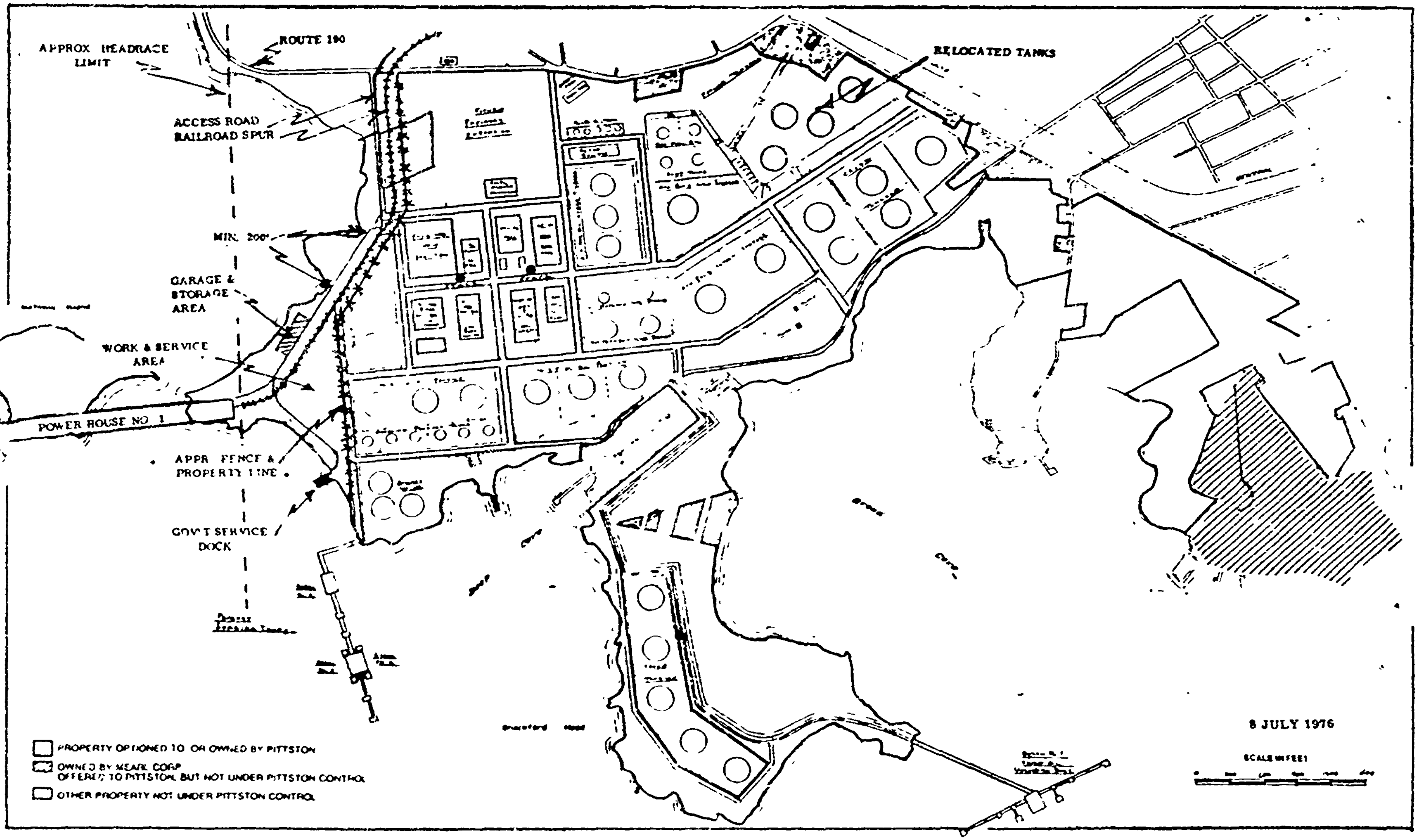
The Benefit-Cost Ratio for some alternatives will be reduced when larger size navigation locks are included. A preliminary estimate of the Benefit-Cost reduction for power only based on proportionment is as follows:

All American Tidal Power Concept	Total Invest. Cost With Basic Lock	Total Invest. Cost With Larger Locks
	Single Pool	
Alt. 4 w/5 units	281,730,000	422,897,000
Alt. 5 w/10 units	371,757,000	512,924,000
Alt. 6 w/20 units	635,022,000	776,189,000
	Double Pool	
Alt. 7 w/Aux.	284,856,000	371,299,000
Alt. 8 w/o Aux.	274,045,000	360,488,000

Notes:

1. Alt. 4 requires a lock approximately 1250' x 180' x 67' at a Total Investment Cost of $141,167,000.
2. Alt. 8 requires a lock approximately 830' x 120' x 42' at a Total Investment Cost of $86,443,000.
3. On the 2-pool alternative, an additional interpool lock (probably 95' x 25' x 12') will be required for small commercial and recreational craft.

MODIFIED LAYOUTS OF
PITTSTON REFINERY AND PASSAMAQUODDY TIDAL POWER



J. Results of Tidal Power Study by Energy Research and Development Administration (ERDA) (Now Dept. of Energy)

This study on tidal power by the Energy Research and Development Administration (Department of Energy) and their consultant, Stone & Webster Engineering Corporation, completed in April 1977, indicated that the concepts evaluated are not economically feasible utilizing the conventional economic analysis mehtod and current price levels. Their study resulted in Benefit-Cost Ratios between 0.32 and 0.50 to 1.00 when only the power benefit was considered. When estimated area redevelopment, fisheries and recreation benefits were incorporated, the B-C ratio increased to 0.48 through 0.69 to 1.00. The ancillary benefits were furnished by the New England Division.

The tidal power concepts evaluated in the ERDA (DOE) report in the Passamaquoddy/Cobscook Bay region are:

ERDA Concept No.	Size	Name	No. Pools	Concept Layout
M-1	500 MW	International	2	(1964 Layout)
M-2	1000 MW	International	2	(1964 Layout)
M-3	180 MW	All-American	1	(Alt. x)
M-4	180 MW	All-American	1	(Alt. x)

The analysis of the M-3 concept, a variation of the 1935 Plan, by life cycle costing methods indicated that to obtain a Benefit-Cost Ratio of 1.00, a fuel cost rise of 5.2 to 5.4% per year would be needed. The slight difference in percentage is whether or not pumped storage backup facilities are provided.

Their notation on the economic feasibility of the tidal power projects in Maine indicated that:

"Considering power facilities only, it is necessary to have a benefit-cost ratio of at least 1.00. Under these conditions, the proposed tidal power projects would not be worthy of any further consideration. However, with the diminishing of U. S. supplies of oil and natural gas, and the strong prospects of continually rising prices for these fossil fuels, life cycle cost analyses certainly appears to offer a better means for evaluating the feasibility of tidal power projects."

As a matter of information, their evaluation of possible tidal power projects in Alaska shows that the power benefits are much lower than those obtained for the tidal projects in Maine. The Benefit-Cost Ratios for power at the Alaskan sites considered vary between 0.15 and 0.31 to 1.00. These lower ratios are attributed to higher construction costs in Alaska and lower estimated fuel costs for the "alternative" coal-fired plant.

Following is a brief preliminary comparison of the separate tidal power economic studies accomplished by the Energy Research and Development Administration and the Corps of Engineers in the Passamaquoddy/Cobscook Bay region:

By Conventional Method of Analysis (For Power Only)*

Project	Benefit Cost Ratio (BCR) Corps	ERDA (DOE)
500 Megawatt International Plan	0.53 to 1.00	0.50 to 1.00
1000 Megawatt International Plan	0.49 to 1.00	0.32 to 1.00
Typical All-American Plans	0.31-0.45 to 1.00	0.36-0.51 to 1.00

By Life-Cycle Costing Method (For Power Only)*

Project Evaluated	Corps Findings
500 Megawatt International Plan	Project will commence to be cheaper to operate than an oil fired alternative after the 20th year based on a 5% compounded escalation rate and 6-3/8% financing rate.
	ERDA FINDINGS
180 Megawatt All-United States	Project will commence to be cheaper to operate after 13 years than an oil fired alternative based on a 5.5% fuel rise per year and interest rate of 7%.

*Ancillary benefits of area redevelopment, fisheries-mariculture and recreation are not included. It is noted that all possible tidal power concepts in Cobscook/Passamaquoddy Bay were not studied by life-cycle analysis, however it is felt that most plans would be economically feasible when evaluated by this method, some sooner than others.

K. Project Study Concerns and Future Considerations

The tidal power project is unique and offers many problems and question which have to be addressed. Some of these are:

a. Engineering

- Investigations of new construction methods for prefabrication and float-in construction of power house bays and emptying and filling gate units.

- Investigations into alternate methods of constructing the earth and rock-filled dams in view of water depths up to 300 feet and high velocities of the tidal current.

- Investigation of methods to reduce cofferdam requirements which amount to a large portion of project constructions costs especially where the fill-emptying gates are concerned.

- Confirmation of barrier closure method, near the completion of the project when it is estimated that tidal velocities will increase to the range of 20 feet per second. This will pose engineering and design problems without precedent.

- Investigating Quality Control programs for proper compaction during dam construction so as to assure maximum water-tightness of dams.

- Accomplishment of studies on corrosion mitigation to reduce high cost of gate track and exposed equipment in the emptying and filling gates.

- Studies into location of spoil areas for surplus excavated materials.

- Studies to determine if the present dam embankment cross-sections, materials and sequence of their construction can be altered to reduce costs without sacrificing construction feasibility.

- New transmission facilities studies to determine the nearest points of connection to the New England electrical grid which was previously not in operation during the 1956 - 1959 study.

b. Marketability of Electric Power

An indepth review of electrical power production needs in New England and an analysis of trends in the generation plant expansion program, including delays being encountered, is necessary to determine when and how the tidal power project is best scheduled to join the electrical generation system in New England.

c. Environmental

- The tidal power project construction operations would cause many temporary impacts through dredging and filling activities.

- The dams would form pools and impounded area which will alter bay temperatures, movement of marine shellfish and finfish, tidal flat areas, tidal currents and velocities, and tidal resonance characteristics along the coast.

- The height and range of the tides in the various pools will be changed which will affect the shoreline and high-low water lines, and have other coastal zone impacts.

- Investigations and studies for providing fishways in the tidal power project will have to be conducted.

- The necessity of constructing a physical model to determine and validate impacts on water quality circulation, sedimentation, etc., caused by construction of the project may be required. The construction and setting-up of a physical model of the project site would cost approximately $900,000 and would be subject of a future Fiscal Year funding request.

d. Social

- Investigations of the impacts on the region and communities by the influx of construction workers will have to be conducted. This would include impacts on community services, transportation, housing, etc.

- Studies on employment and the labor needs to construct the project must be carried out.

e. Waterbourne Navigation

Surveys will have to be conducted on the history and use of waterbourne transportation in the Passamaquoddy area to provide up-dated information for navigational locks and their sizes. The cost of navigational locks could contribute greatly to the cost of the overall project.

f. Project Benefits

Although the tidal power project's main purpose is to develop electrical power, ancilliary benefits from the following will be derived which must be investigated:

- <u>Mariculture-Fisheries</u> - Numerous sources claim that the new impounded pools will contribute immensely to mariculture development and result in large annual fisheries benefits to the region.

- <u>Area Redevelopment</u> - With the construction of a large multi-million dollar tidal power project, it is anticipated that the local population in Washington County and Maine will provide the majority of the labor force. These wages in turn will provide economic benefits to the regions.

- <u>Recreation</u> - Construction of the unique, one of a kind in the United States, tidal power project would undoubtedly increase tourism and recreation in the region.

g. <u>Project Economic Feasibility</u>

In view of the fact that preliminary analysis of the tidal power project, utilizing power benefits only, indicates that the Benefit-Cost Ratio is less than unity it is considered difficult to justify a project by this basis only.

On the other hand an analysis of the project by the "life-cycle costing" method, which is not presently authorized for water resource type projects, does possess merit under the present energy situation. There is concern on whether the use of this analysis as the economic basis for the project will be authorized for continuing study and eventual implementation of the project.

h. Miscellaneous

This project will also impact many other areas which will require investigations and reporting on such as lana use, sources of nature materials for construction, highways, communications, and cultural factors which will raise concerns of the inhabitants of the region.

i. The Life-Cycle Analysis

The life-cycle analysis as presented in the Reconnaissance Report is based on a general inflationary rate of all items. In future study efforts the life-cycle study will be based on a relative escalation rate of fuel oil only in comparison with the general inflationary rate of all other items.

j. Constraints

The present programmed funds do not contain sufficient amounts for providing a physical model of Cobscook Bay and the project to fully evaluate water quality, circulation studies, etc. In view of this there will be constraints in furnishing supportive and validating information for the Environmental Impact Statement. If the project is deemed economically feasible and further study is warranted upon completion of Intermediate or Final Stages of the Survey Scope Study, it will probably be recommended at that time to higher authority that a physical model be constructed for accomplishment of a full environmental evaluation.

L. Summary of Findings and Conclusions

1. The estimated Total Investment Cost of the Cobscook Bay Plans, which include Construction Costs and Interest during Construction, varies between $274,045,000 and $635,022,000; and the estimated annual electrical generation of the concepts range from 292,000,000 to 615,000,000 kilowatt-hours.

2. The conventional benefit-cost analysis for the Cobscook Bay was based on 30 June 1976 price levels, and the life-cycle evaluation of the 500 MW International Plan was based on prices and predictions of the same period.

3. The benefit-cost ratio for the All-American Plans, considering power benefits only, varies between 0.31 and 0.45. This ratio increases to a range of 0.55 and 0.77 when anticipated ancillary benefits of area redevelopment, fishereis-mariculture and recreation are included.

4. Utilizing the Total Investment Cost, the cost of installed power on a per kilowatt basis varies between $2,540 and $7,121 for the five alternatives considered.

5. The construction of any one of the United States Plans would not entail in-depth negotiations, international agreements, considerations, etc. which the international plans would require. However, activities in informational service on project planning, engineering and impacts as well as coordination on the project in general with Canada would be appropriate. All

electrical power generated from Cobscook Bay would be utilized within the United States.

6. The results of the DOE-ERDA study indicate that tidal power development is not economically feasible in the Passamaquoddy/Cobscook Bay region when evaluated on the conventional method of analysis for water resource projects, however, evaluation on a life-cycle basis indicated that a project may be feasible.

7. Proposed Oil Refinery and Marine Terminal in Eastport

With respect to the proposed Pittston Company oil refinery and marine terminal in Eastport, Maine, a public hearing on the draft Environmental Impact Statement was jointly held by the Corps of Engineers and Environmental Protection Agency on 3 December 1976 in Eastport, Maine. The final Environmental Impact Statement by the Environmental Protection Agency, Region I was issued in August 1978.

In the event the refinery is constructed, a navigational lock larger than one originally planned for the tidal project might be required.

8. For both conventional economic analysis and life cycle analysis both the Corps and ERDA found similar results.

9. A separate preliminary study on tidal power has been conducted by Office of Technical Assessment, Congress of the United States. Preliminary information of their draft report entitled "Tidal Power", dated February 1977, indicates that a tidal power project in the

vicinity of Passamaquoddy and Cobscook Bays may be attractive for development if fuel costs for thermal plants continue to escalate, and that the project should be evaluated and justified on the life-cycle costing method.

10. Relationship of Passamaquoddy Tidal Power Project with the President's Energy Program of 20 April 1977

Reference: Text of Fact Sheet on the President's Program issued by White House Energy Staff, 20 April 1977.

The following is based on a preliminary review of the referred to Energy Program Fact Sheet and contains comments on the relationship of the Passamaquoddy Tidal Power Project to the Energy program. The Sections of the program are listed with comment as follows:

I. National Energy Policy, Principles, Strategies and Goals

A. Prinicıples:

- The project conserves petroleum, a natural resource.
- The project causes limited environmental impacts. There would be practically no air, noise, land or water pollution. There would be some aquatic, terrestrial and wetlands impacts caused by the tidal pools. There would be no solid or liquid waste disposal problems.
- The national and regional vulnerability to embargoes and uncertain supplies would be reduced.

B. Strategy:

- Dependency on foreign oil is reduced.
- The project operates on development of a new, dependable, renewable and inexhaustible source of energy -- tidal power.
- The project helps to sustain economic growth.
- The project affords an opportunity to implement the natural resource conservation program.

C. National Energy Goals:

- The project would help the nation in reducing foreign oil imports.

- Allows further conservation of domestic energy sources.

II. Effects of the President's Energy Plan

- The project will save approximately up to 860,000 barrels of oil annually or about 2,350 barrels on a per day basis.

- The project would have a positive impact on the national, regional and statewide economy.

III. The President's Energy Program

A. Conservation

1. Transportation -- no apparent relationship.

2. Buildings -- no apparent relationship.

3. Appliances -- no apparent relationship.

4. Industrial Conservation -- no apparent relationship.

5. Cogeneration of Electricity and Process Steam

   - The project has relatively high efficiency and does not waste enormous amounts of energy in the generation of electric power.

6. DistrictHeating -- no apparent relationship.

7. Utility Rate Reform - no apparent relationship.

8. Taxes on Oil and Natural Gas -- no apparent relationship.

B. Management Information Systems

1. Petroleum Production and Reserves Information -- no apparent relationship.

2. Petroleum Company Financial Data System -- no apparent relationship.

3. Emergency Management Information System -- no apparent relationship.

C. <u>Industry Competition</u> -- no apparent relationship.

D. <u>State and Local Government Participation</u>

The Passamaquoddy Indian Tribal Council, Pleasant Point Reservation, Perry, Maine has proposed a small 5-12 Megawatt tidal power and mariculture development project in Half Moon Cove in Cobscook Bay, Maine. The United States tidal power plans which this Division is re-evaluating would involve Cobscook Bay. The federal concepts offer various degrees of compatibility with the tribal plan and some construction mofifications and mode of operations would be required to the tribal project if the large federal project is ever built. It has been recommended to the council that they coordinate their planning with the New England Division in respect to water pool levels, elevations and inverts of structures, etc., of their proposed facility. Their mariculture development would have to be coordinated with both their own and the federal tidal power projects in establishing pool elevatiions, retention and release of waters, etc.

E. <u>Assistance for Low Income Persons</u> -- no apparent application.

F. <u>Oil and Natural Gas</u> - Except for minimum requirements for maintenance activities the project will not use oil or natural gas.

1. <u>Oil Pricing (legislative)</u> -- no apparent application.
2. <u>Oil Taxes (legislative)</u> -- no apparent application.
3. <u>Natural Gas Pricing (legislative)</u> - no apparent application
4. <u>Other Oil and Gas</u> -- no apparent application.

G. Coal, Nuclear and Hydroelectric Power

The tidal power project relies on harnessing the high tidewaters of Cobscook Bay in Maine and does not require conventional energy sources such as coal, oil or natural gas.

1. Oil and Natural Gas Users Tax (legislative)

It is felt that with the additional taxes which could be imposed on private electric generating utilities for utilizing oil, that the BCR economics of the tidal power project would improve.

2. Coal Conversion Regulatory Policy (legislative)

The tidal power plant would not be involved with conversion to coal, oil or gas fuels.

3. Environmental Policy for Coal

The tidal power plant will not use coal and therefore is not involved with meeting emission standards for coal. In addition, the project will not have a solid waste disposal problem such as coal ash.

4. Coal Research and Development (Budget)

No apparent application

5. Nuclear Power

No apparent application

6. Hydroelectric Power

This section states the following and since the Quoddy project is not an existing dam the section seems to have no apparent direct application:

"The President has directed the Corps of Engineers to report within three months on the potential for additional hydropower installations at existing dams throughout the country - especially at small sites. Any recommendation will be subject to a thorough environmental and budget review before final decisions are made (administrative)."

H. Nonconventional Sources of Energy

The tidal power prject utilizes the high tides in the Cobscook Bay region which are a dependable, renewable and inexhaustible source of energy. A project such as this assists the nation in its hope for long term economic growth beyond the year 2000.

It is noted that in addition to the current Corps of Engineers work on the Passamaquoddy Tidal Power Project, the Solar Energy Division of Energy Research and Development Administration and the U. S. Congress Office of Technical Assistance are both accomplishing separate tidal power studies which are investigating and reporting the economic feasibility of tidal power in the Passamaquoddy region.

1. Solar Energy

See preceding comment, otherwise there is no apparent application with this section.

2. Geothermal Energy

No apparent application.

I. Research, Development and Demonstration of Decentralized Systems

1. Reorganization (Administrative/budget)

No apparent application.

2. Solar, Geothermal and Other Technologies (budget)

No apparent application.

J. Transportation Study

No apparent application, except that the tidal power project would not have to depend on transportation service for supplying fuels.

II. In December 1976 the State of Maine Office of Energy REsources completed a report titled "Maine Comprehensive Energy Plan, 1976 Edition". The document reviews the energy situation, consumption and needs for the state. With respect to tidal power, their preliminary recommendations which could be undertaken concerning resource development and diversification are as follows:

By State of Maine entities

Further consideration of tidal development as an energy alternative for Maine should await release of the ERDA study of tidal power. If eventual (within 30 years) technical and economic feasibility can be demonstrated for tidal power by life cycle cost calculations (being undertaken in the Stone and Webster study at Maine's request), then the Passamaquoddy Tidal Power site should be retained intact as an option for future energy supply to Maine.

M. FUTURE PROJECT USE

In reviewing the All United States Plans and the current impediments which the development of nuclear power in New England is encountering there may be a future desire and need for an All United States Plan which will produce the maximum amount of energy rather than a prinicpally peaking facility. In this event, single pool alternative x with 20 - 12,500 KW generators (250 KW) would be preferable as it will produce the greater amount of energy. In comparison, however, two pool alternative y without auxiliary will render a better B/C ration, provide more flexible use for providing peaking and maximum energy, but will produce less electricity on an annual basis. If the tidal power project is authorized for further study the plant use and mode of operation must be determined early. This would be done in conjunction with all concerned so that the proper tidal power plant will be planned which will be most advantageous for the State of Maine and New England.

N. PUBLIC INVOLVEMENT PROGRAM RESULTS

The results of the Public Involvement Program conducted during the Stage I period through workshops and public meetings, indicated that there was very little objection to the study on the project. Also, that there were considerable environmental questions and issues which will have to be addressed in any further study.

O. RECOMMENDATIONS FOR FURTHER STUDY

Based on the need for additional generating facilities in the State of Maine and New England to reduce the regions dependency of foreign fuels, to utilize a daily renewable regional resource, and the anticipated merits of the project by life cycle costing analysis; it appears that further study of the project should be continued.

Further, that based on the results of the Preliminary Economic Feasibility Study dated 29 April 1977 and concurrence from Office Chief of Engineers in 1st Indorsement dated 28 September 1977 to NED basic correspondence dated 31 May 1977, subject "Passamaquoddy Tidal Power Project (CWIS #14023)", NED has proceeded to prepare a Plan of Study and Reconnaissance Report. (See Attachment Nos. 13, 14, and 15).

The economic feasibility of the project will be continuously reviewed throughout the study to determine if the study should be continued or terminated.

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

ATTACHMENTS

TO

STAGE I

RECONNAISSANCE REPORT

ATTACHMENTS
TO
STAGE I
RECONNAISSANCE REPORT

ATTACHMENT NO.	DESCRIPTION/TITLE
1	• New England System Capability
2	• Summary of System Capabilities and Estimated Peak Load
3	• Summary of Generation Additions Ratings and Retirements
4	• Tidal Power in Cobscook Bay All-American 1935 Plans
5	• References
6	• Letter dated 7 September 1976 from Governor of Maine
7	• NED letter dated 24 September 1976 to Governor of Maine
8	• Federal Power Commission letter dated 12 August 1976
9	• Potential of Mariculture in the Passamaquoddy and Cobscook Bay Region
10	• Senate Resolution dated 21 March 1976
11	• List of Previous Reports on the Passamaquoddy Tidal Power Project
12	• List of Other Recent and On-going studies in the Region

Attachment No. 1

NEW ENGLAND SYSTEM CAPABILITY*

Type of Installation	Mode of Operation	Actual Dec. 75 MW	Capability 1975/76 thru 1986/87: NEPOOL Authorized Additions MW	NEPOOL Planned Capability** MW	Proposed Additions Under Study or Planned MW	Proposed Gross Capability MW
Nuclear	B	3364	8910	12371	1150	13521
Conventional Thermal	B/M	11914	1160(M)	13062	--	13062
Net Power Purchases	B/M/P	192	21	213	--	213
Combined Cycle	M	90	385	475	180	655
Hydro	B/M/P	1288	--	1273	12	1285
Gas Turbine	P	1489	120	1609	105	1714
Diesel	P	243	--	243	44	287
Pumped Hydro	P	1632	--	1632	--	1632
Fuel Cells	P	--	--	--	26	26
Peaking Fossil	P	--	--	--	150	150
TOTAL		20212	10596	30878	1667	32545
Estimated peaking capacity (20%)		4000		6000		

* New England Load and Capacity Report, 1975-1986. NEPLAN, January 1, 1976.
** Including authorized rerating and retirements.

B = Base-Load Plant
M = Mid-Range Plant
P = Peaking Plant

ATTACHMENT NO. 1

Attachment No. 2

SUMMARY

SYSTEM CAPABILITIES AND ESTIMATED PEAK LOAD - WINTER - 1977/78-1987/88

MW

	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88
...tal Capability* Item #25	21950	22568	22569	22572	23984	25255	26407	28732	28531	30631	30630
...tal Peak Load Item #26	15217	16051	16918	17846	18820	19814	20851	21964	23134	24379	25694
...serve Before ...intenance Item #27	6733	6517	5651	4726	5164	5441	5556	6768	5397	6252	4936
Reserve Before ...intenance Item #28	44.2	40.6	33.4	26.5	27.4	27.5	26.6	30.8	23.3	25.6	19.2
...heduled ...intenance Item #29	400	900	800	0	0	0	0	0	0	0	0
...serve After ...intenance Item #30	6333	5617	4851	4726	5164	5441	5556	6768	5397	6252	4936
Reserve After ...intenance Item #31	41.6	35.0	28.7	26.5	27.4	27.5	26.6	30.8	23.3	25.6	19.2

* Additions include only "NEPOOL Planned" generating capacity.

Includes 278.25 MW of deactivated reserve through October, 1983, and 196.75 through remainder of report.

Data from NEPLAN, January 1, 1977

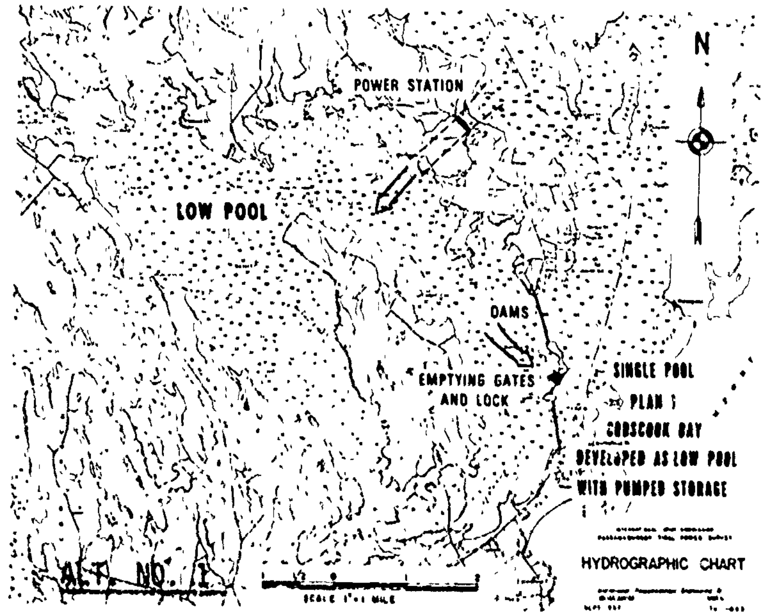
ATTACHMENT NO. 2

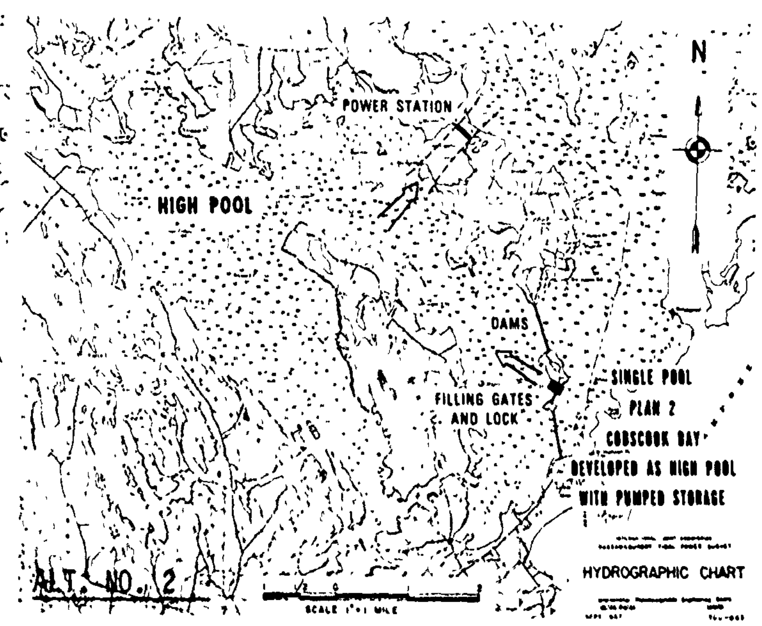
	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/8
Existing Capability	21457	21576	21594	21595	21598	21590	21591	21674	21669	21468	21268
Retirements	-6	0	-2	0	-9	0	0	-6	0	0	0
Reratings	+112	+16	0	0	0	0	+81	0	0	0	0
Adj. for Purchases & Sales	+13	+2	+3	+3	+1	+1	+2	+1	-1	0	-1
MEPCO/NB Purchase	-	-	-	-	-	-	-	-	-200	-200	0
Net Capability	21576	21594	21595	21598	21590	21591	21674	21669	21468	21268	21267
Deactivated Reserve Units	278	278	278	278	278	278	278	197	197	197	197
Adj. for Deactivated Reserve Units	-	-	-	-	-	-	-81	0	0	0	0
NEPOOL Planned Units											
Potter #2 (1/1/77)	96	96	96	96	96	96	96	96	96	96	96
W. F. Wyman #4	-	600	600	600	600	600	600	600	600	600	600
Mass. Municipals - CC	-	-	-	-	270	270	270	270	270	270	270
Seabrook #1	-	-	-	-	1150	1150	1150	1150	1150	1150	1150
Millstone #3	-	-	-	-	-	1150	1150	1150	1150	1150	1150
Mass. Municipals - CT	-	-	-	-	-	120	120	120	120	120	120
Seabrook #2	-	-	-	-	-	-	1150	1150	1150	1150	1150
Pilgrim #2	-	-	-	-	-	-	-	1180	1180	1180	1180
NEPCO #1	-	-	-	-	-	-	-	1150	1150	1150	1150
Sears Island	-	-	-	-	-	-	-	-	-	1150	1150
NEPCO #2	-	-	-	-	-	-	-	-	-	1150	1150
Total Capability *	21950	22568	22569	22572	23984	25255	26407	28732	28531	30631	30630

*NOTE: Additions include only "NEPOOL Planned" generating capacity. Data from NEPLAN January 1, 1977.

Deactivated Reserve Units as of 1/1/77 = 140.3 of NU capability, 81.5 MW of EUA capability, and 56.45 MW of UI capability.

ATTACHMENT NO. 3


N
POWER STATION
LOW POOL
DAMS
EMPTYING GATES
AND LOCK
SINGLE POOL
PLAN 1
COBSCOOK BAY
DEVELOPED AS LOW POOL
WITH PUMPED STORAGE
HYDROGRAPHIC CHART
ALT. NO. 1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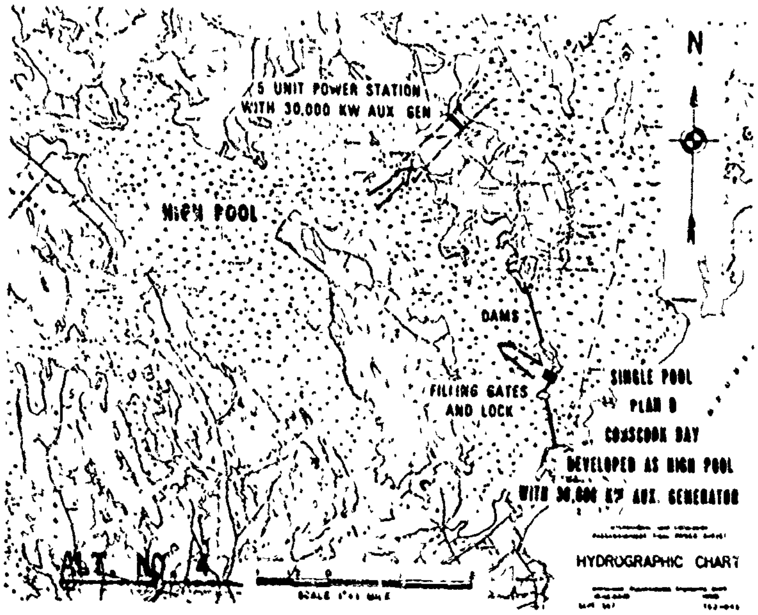
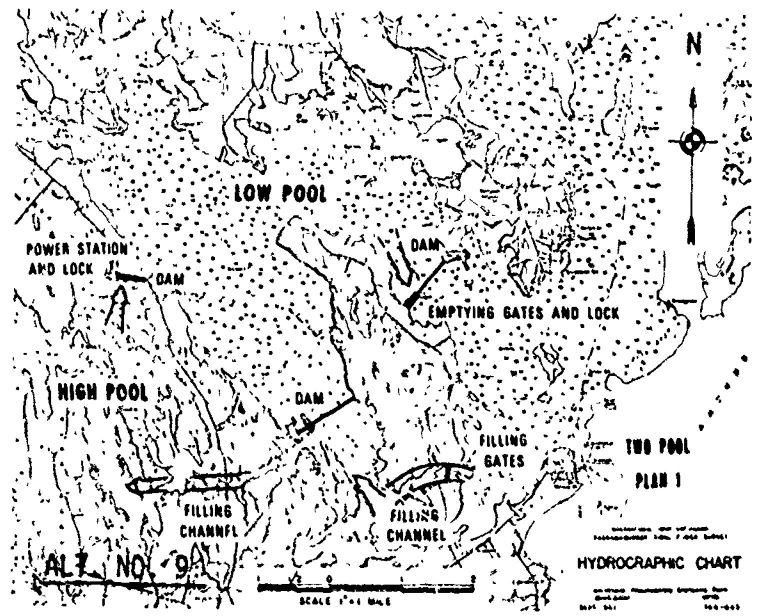
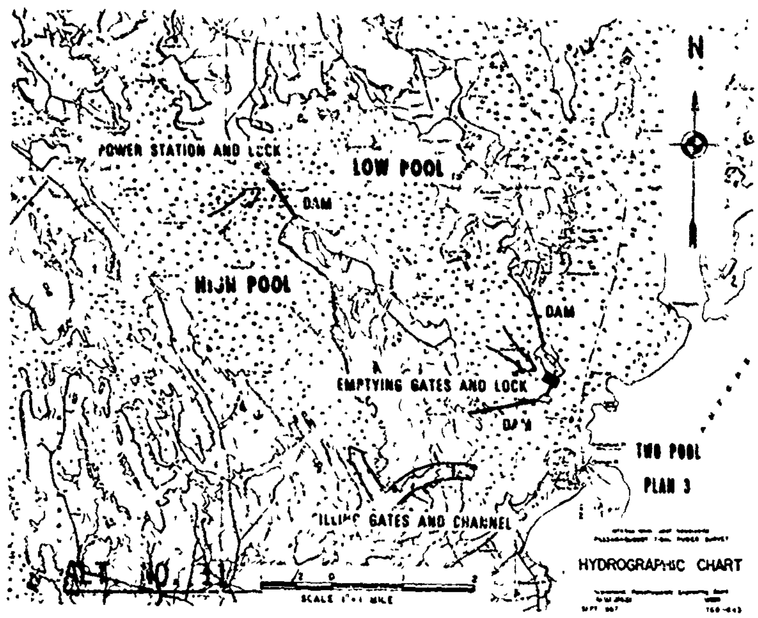
HIGH POOL
DAMS
FILLING GATES
AND LOCK
SINGLE POOL
PLAN 2
COBSCOOK BAY
DEVELOPED AS HIGH POOL
WITH PUMPED STORAGE
HYDROGRAPHIC CHART
ALT. NO. 2


N
5 UNIT POWER STATION
WITH 30,000 KW AUX GEN
HIGH POOL
DAMS
FILLING GATES
AND LOCK
SINGLE POOL
COBSCOOK BAY
DEVELOPED AS HIGH POOL
HYDROGRAPHIC CHART
ALT. NO. 4


N
LOW POOL
POWER STATION
AND LOCK
DAM
EMPTYING GATES AND LOCK
HIGH POOL
DAM
FILLING
GATES
FILLING
CHANNEL
FILLING
CHANNEL
TWO POOL
PLAN 1
HYDROGRAPHIC CHART
ALT. NO. 9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LOW POOL
DAM
HIGH POOL
DAM
EMPTYING GATES AND LOCK
TWO POOL
PLAN 3
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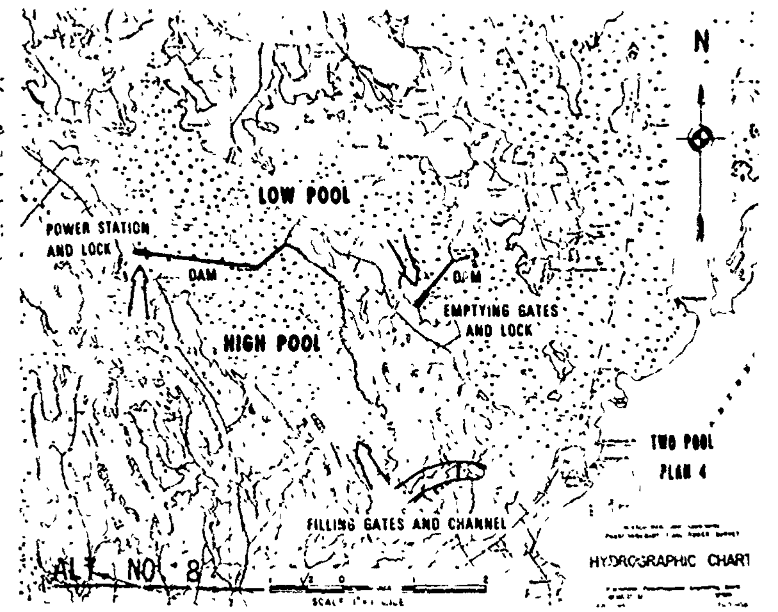
ALT. NO. 3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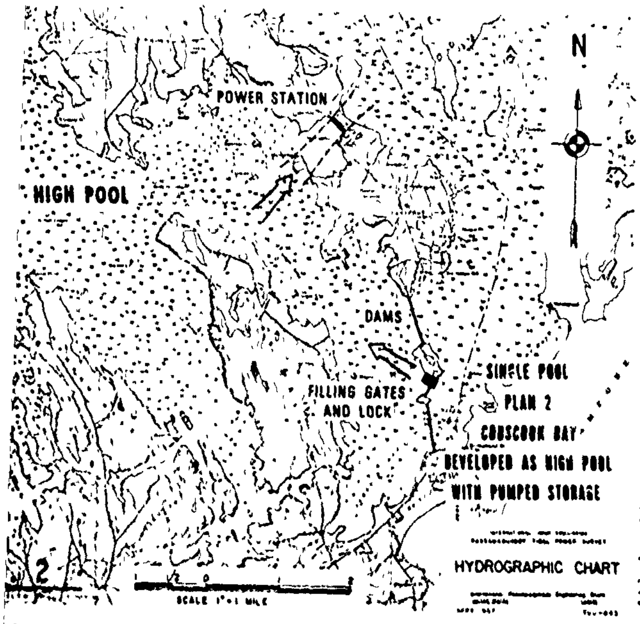
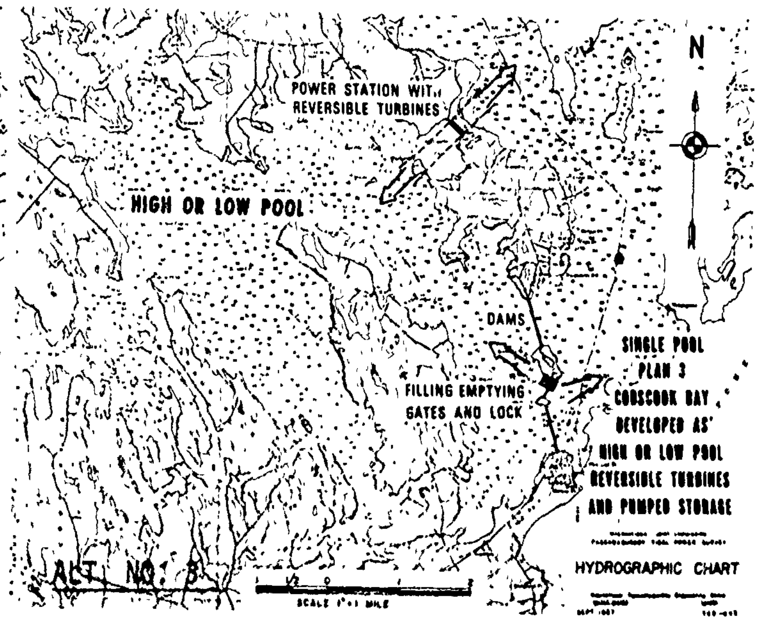
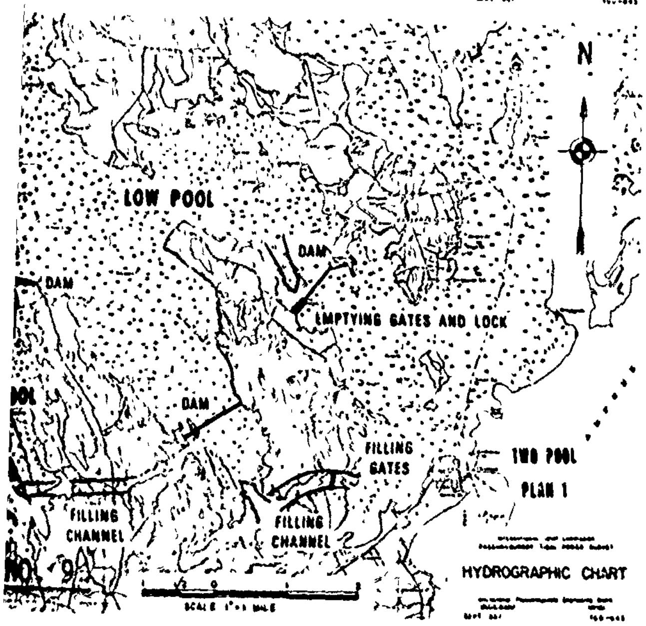
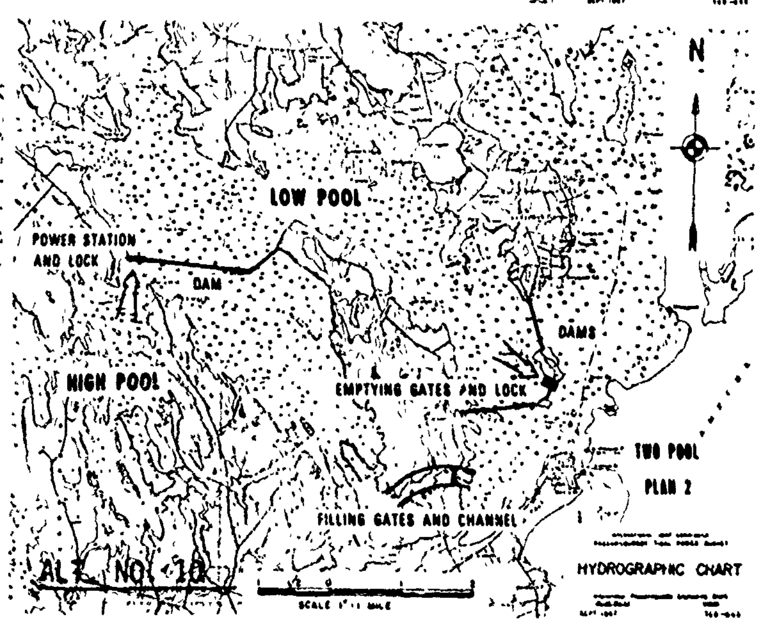
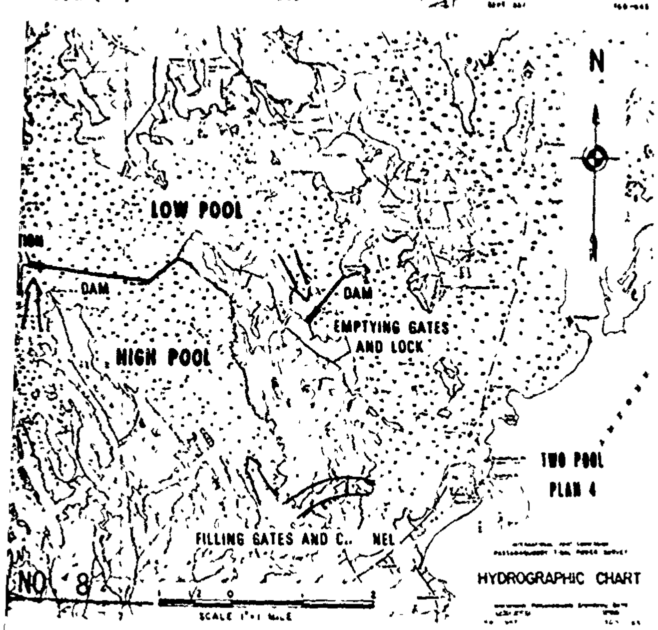
LOW POOL
POWER STATION
AND LOCK
DAM
DAM
EMPTYING GATES
AND LOCK
HIGH POOL
TWO POOL
PLAN 4
FILLING GATES AND CHANNEL
HYDROGRAPHIC CHART
ALT. NO. 8











TIDAL POWER IN COBSCOOK BAY

ALL UNITED STATES

1935 PLANS

NEW ENGLAND DIV.

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REFERENCES:

The following references have been utilized in preparing the latest updated project cost estimate and benefits in this economic feasibility report:

1. Report to the International Joint Commission by the International Passamaquoddy Engineering Board, titled: Investigation of the International Passamaquoddy Tidal Power Project, dated October 1959, with nineteen (19) appendices.

2. Report of the International Joint Commission, Docket 72, Investigations of the International Passamaquoddy Engineering and Fisheries Board, titled: Investigation of the International Passamaquoddy Tidal Power Project, dated April 1961.

3. Report from Secretary, Department of the Interior, dated July 1963, titled: The International Passamaquoddy TIDAL POWER PROJECT and UPPER SAINT JOHN RIVER Hydroelectric Power Development.

4. Supplement to July 1963 Report, The International Passamaquoddy TIDAL POWER PROJECT and UPPER SAINT JOHN RIVER Hydroelectric Power Development dated August 1964, prepared by Passamaquoddy - Saint John River Study Committee.

5. Corps of Engineers Manual EM 1110-2-1302, dated 1 November 1967 with Change 1 dated 10 February 1972, titled: Engineering and Design, COST ESTIMATES, Government Estimate of Fair and Reasonable Cost to Contractor.

6. Corps of Engineers Manual EM 1110-2-1301, dated 17 March 1972, titled: Engineering and Design, COST ESTIMATES, Planning and Design Stages.

7. Several miscellaneous project quantity surveys and cost estimates for the tidal project, prepared during the general period 1957-1963, are in the New England Division in their original engineering computation form.

8. Water Resources Council (WRC) regulations, December 1968.

9. Water REsources Development Act of 1974, 7 March 1974.

10. Senate Document No. 97, 87th Congress, entitled: Policies, Standards and Procedures in the Formulation, Evaluation and Review of Plans for use and Developement of Water Related Land Resources.

11. Senate Resolution 148.

12. Resolution adopted on 21 March 1975 by the Committee on Public Works, United State Senate as sponsored by Edward S. Muskie, Senator from Maine.

13. Public Law 94-180, Public Works Appropriations Act for Fiscal Year 1976 approved on 26 December 1975.

14. Results of revised construction engineering, operations and maintenance cost estimate prepared for the Corps of Engineers, New England Division by the firm of Stone and Webster Engineering Corporation, under NED Contract No. DACW33-76-C-0081 dated 28 April 1976.

15. Lr .. from Federal Power Commission, New York, dated 12 August 1976 containing updated power information for the project.

16. Memorandum dated 10 August 1976 and Supplemental Report No. 1 thereto from NED Real Estate Division on revised costs for Lands and Damages.

17. Memorandum dated 26 August 1976 from NED Planning Division on revised benefits derived from the project for recreation.

18. Memorandum dated 4 October 1976 from NED Planning Division on revised benefits derived from the project for area re-development.

19. Report entitled "An Environmental Assessment Report", dated 8 March 1976 prepared by Enviro-Sciences, Inc. for the proposed 250,000 BPD Fuels Refinery and Deepwater Marine Terminal at Eastport, Maine, USA.

20. Preliminary proposal, undated, entitled "Passamaquoddy Marine Resources Development by the Passamaquoddy Tribe, Community Development Office, Pleasant Point, Perry, Maine.

21. Memorandum dated 1 November 1976 from NED Planning Division on benefits derived from fisheries and mariculture.

22. Institute for Water Resources Research Report 75-R1, dated 11 July 1975, titled "Hydroelectric Power Potential at Corps of Engineers Projects".

23. Draft of Final Report entitled "Tidal Power Study" dated January 1977 prepared by Stone & Webster Engineering Corporation for the U. S. Energy Research and Development Administration, Division of Solar Energy, under Contract No. E (49-18)-2293.

24. Memorandum dated 19 February 1936 by United States Engineer Office, Eastport, Maine, subject: Comparison of Best American Two Pool Tidal Hydro-electric Plan with Single Pool.

25. Memorandum dated 22 May 1936 by United States Engineer Office, Eastport, Maine, subject: Revised Estimate of Plan "D".

STATE OF MAINE
OFFICE OF THE GOVERNOR
AUGUSTA, MAINE
04330

JAMES B. LONGLEY
GOVERNOR

September 7, 1976

John Leslie
U. S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

I realize the Federal government is studying tidal power to determine its feasibility, especially in Passamaquoddy Bay.

We are of the opinion that, in order for these studies to be worth the taxpayer dollars being spent on them that they must include a per KWH life cycle cost analysis of the proposed Quoddy project and a comparison of the projected cost of the alternatives (nuclear, coal, oil-fired and river hydro) ten or twenty years from now, when the next large scale generating facilities will actually be needed.

We are greatly disturbed that neither the Corps of Engineers nor ERDA has seen fit to include this type of cost projection in the scope of work to be performed by the Stone and Webster Company, although Mr. Wayne has publicly recognized that if Quoddy had been built years ago its power would be a bargain today.

We feel no one is going to be enlightened by a study which quantifies the obvious, namely that Quoddy will cost more to build now than 20 years ago, or that it will cost more to build than some other type of facility. What we need to know from a power-cost standpoint is the value of Quoddy in ten or twenty years with the fuel costs of other types of power rising? We also would like to know from an overall public investment standpoint, what would be the external benefits of the project to the affected region, which is characterized by its remoteness, coldness, low-incomes and high energy costs?

Until your studies attempt to answer these questions in a preliminary fashion, we must conclude that they are not only worthless as a planning tool, but may actually produce

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prejudices which would forever condemn the Quoddy project as "economically unfeasible" and thus deprive the State and the Nation of our best hope for a tidal project.

We feel that it is feasible for you to make the projections we have described within the terms and budgets of your current contracts, and look forward to a letter from you stating that you have indeed decided to do so.

Very truly yours,

James B. Longley

JAMES B. LONGLEY
Governor

JBL/gwd

cc: Abbie Page, Director, Office of Energy Resources
Allen Pease, Director, State Planning Office

NEDED 24 September 1976

Honorable James B. Longley
Governor of the State of Maine
State House
Augusta, Maine 04330

Dear Governor Longley:

This is in response to your letter of 7 September 1976 addressed to Mr. John Wm. Leslie of my staff relative to the economic analysis of the Passamaquoddy Tidal Project now under study.

Your proposal of a life cycle cost analysis, as you may know, is not the conventionally dictated method of analysis as established by the Congress for the evaluation of water resource projects. However it can be developed and based upon approval of our Washington headquarters, we will develop same for your personal use.

As you have probably been informed, Mr. Leslie met with Mrs. Page and Mr. Silverman on 15 September 1976, at which time the subject matter was discussed. I would like to again reiterate some of the key points and warnings in respect to use of projected power benefits that would be required in an economic analysis. There is no problem in establishing the estimate of the project in today's market which is readily converted to an annual cost thus providing the cost side of the benefit to cost equation. The creditability of the benefit side will depend on a great number of assumptions: what will be the least expensive privately-financed alternative; what will be the price of alternative fuel; how will energy forms of generation change, if any; what will be the value of power; what will be the state of the national economy. All of these

must be projected to the year 1991, the projected date of power on line. Thus benefits will have to be qualified with a statement of the assumption.

As to your comments on external benefits, these are normal factors of any report and of course will be so addressed.

Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

FEDERAL POWER COMMISSION
REGIONAL OFFICE
26 Federal Plaza
New York, New York 10007

August 12, 1976

Mr. John Leslie
Chief, Engineering Division
Department of the Army
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

As requested in your letter of April 19, 1976, we have made a market study and determined at-market and at-site power values for the proposed Passamaquoddy Tidal Project (Quoddy). Since the International Passamaquoddy Engineering Board report in October, 1959, New England's electric utilities have established the New England Power Pool (NEPOOL) and also NEPEX and NEPLAN, NEPOOL operating and planning arms, respectively. The Interconnected New England System is one of four areas comprising the Northeast Power Coordinating Council (NPCC), one of nine Regional Reliability Councils in North America. The New York State Interconnected System, New Brunswick Electric Power Commission, and Ontario Hydro are the other three NPCC entities. In light of these developments and single system approach to bulk power supply planning and operation in the region, the Interconnected New England System was selected as the market for Quoddy power. Also, although international in character, for study purposes, as agreed upon with your staff, Quoddy output was assumed to be utilized solely in the United States. Accordingly, required transmission for the various project installations considered and their economic evaluation were based on the concept of a U.S. market only.

New England is a winter peaking region. The 1975 peak demand of 12.5 million kilowatts occurred on December 19. This is estimated to increase to 23.8 million in Winter 85-86 and to 41.0 million in Winter 95-96. Installed capability in New England totalled 20.0 million kilowatts at the close of 1975 and is scheduled to expand to 28.4 million by the end of 1985 and to 51.0 million in 1995. The following table shows the composition by prime mover type of the 1975 (actual) and 1985 (scheduled) capabilities as reported by the utilities on April 1, 1976 in response to FPC Order 383-3:

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New England

Installed Generating Capability
(Megawatts)

Fossil Steam	11914	13062
Nuclear Steam	3364	10071
IC/GT	1732	1852
Combined Cycle	90	475
Convent. Hydro	1308	1300
Pumped Storage	1632	1632
Total	20040	28392

Of an additional 22.7 million kilowatts currently planned for the decade after 1985, some 15 million are expected to be nuclear.

Our analysis was based on the description of the project in the Passamaquoddy-St. John River Study Committee's August 1964 Supplement to the July 1963 Report of The International Passamaquoddy Tidal Power Project and Upper Saint John River Hydroelectric Power Development. The supplement outlines installation of an initial 500 MW and an ultimate 1000 MW of firm, two hour duration, peaking power. It assumes operation of a two-pool plan with supplemental pumping during the neap tides and stipulates that the use of reversible pump-turbines to increase the head during neap tides will assure the availability of the full installed capacity during all required peaking periods. Detailed information regarding the capacity during off-peak energy production was not available, but peak and off-peak energy production data shown in the report for a three-month period indicated operation of the project at a capacity factor of about 27.5 percent. Annual operations were assumed to conform to the operating mode depicted for this three-month period.

Examination of long range NEPOOL generation expansion plans and system load duration curves showed that the New England load could accommodate Quoddy peaking capacity in the 1990-2000 period. Analysis of historical daily load curves indicated that Quoddy could be "peaked" over a two-hour period on a daily basis. There are, however, some reservations regarding the ability to predict future load shapes with any assurance. The current emphasis in the nation regarding energy conservation and the evolving interest in utility load management raise the possibility that future New England load characteristics may not retain the sharp, short duration load "spikes" experienced in the past. Prior studies by the FPC staff indicated that with some additional pumping, the tidal project could possibly be operated at 500 MW to serve daily

peak loads for up to four hours.

In consideration of the assumed characteristics of the project, combined cycle capacity operating at 30 percent capacity factor was selected as the most appropriate alternative. Capital costs were estimated at $250/kW at June 30, 1976 price levels, heat rate at 9000 Btu/kWh, and fuel costs at $2.50/million Btu's. Annual capacity and variable energy costs of power from the combined cycle alternative delivered to the NEPOOL transmission network, plus any required adjustments, yield at-market power values.

Project transmission requirements were based on consideration of projected power flows on the NEPOOL system and the proposed development at Quoddy and an assumption that Dickey-Lincoln and associated transmission would be in service. For the initial 500 MW installation, two 345 kV outlets were assumed - one to the existing Orrington 345 kV switching station near Bangor, and another to the existing Maine Yankee 345 kV switchyard at Wiscasset. The estimated cost of transmission for this scheme was about 48.5 million dollars.

For the 1000 MW installation, the Quoddy-Maine Yankee 345 kV circuit was looped through an expanded Orrington switching station, and a 345 kW line was added from Orrington to a new substation in the Livermore Falls, Maine area, thence to an assumed Beebee, New Hampshire termination of the Dickey-Lincoln transmission, and to the existing Scobie 345 kV substation near Manchester, New Hampshire. Total cost of required transmission for the 1000 MW proposal was estimated at about 110 million dollars.

Based on the foregoing, at-market and at-site power values as of June 30, 1976 for the proposed Passamaquoddy Tidal Project at ten percent of money (private financing) and 6.375 percent (federal financing) are estimated as follows:

Passamaquoddy Tidal Project
At-Market and At-Site Power Values
(June 30, 1976)

private financed rate
Federal Finance Rate

Cost of Money	%	At-Market 10.0	At-Market 6.375	At-Site 10.0	At-Site 6.375
500 MW Project					
Capacity Value	$/kW/YR	45.00	25.50	28.00	15.50
Energy Value	mills/kWh	24.0	24.0	23.0	23.0
1000 MW Project					
Capacity Value	$/kW/YR	45.00	25.50	25.50	14.00
Energy Value	mills/kWh	24.0	24.0	23.0	23.0

The at-market capacity values reflect a credit applied to the delivered cost of power from the alternative. No adjustment was made to the cost of energy. At-site values reflect the effect of project transmission costs, including losses, on the at-market values.

Pumping energy requirements associated with Quoddy would come from nuclear generating stations in New England. Nuclear capacity is currently projected to be in the order of 25 million kilowatts by 1995. This should be more than sufficient to cover estimated base load requirements and pumping energy needs of pumped storage capacity in service in the time frame assumed for completion of the project. Based on current operating costs, pumping energy costs from nuclear sources are estimated at about 3.0 mills/kWh.

If we can be of further assistance to you in your studies, do not hesitate to contact us.

Sincerely,

James D. Hebson

James D. Hebson
Acting Regional Engineer

ATTACHMENT NO. 9

POTENTIAL OF MARICULTURE IN THE PASSAMAQUODDY BAY AND COBSCOOK BAY REGION

Introduction

The United States has indicated an interest in reviewing the current status of the Proposed Passamaquoddy Tidal Power Project. To this intent, the U. S. Army Corps of Engineers has been directed to update the economics and technology of the original proposal. The final outcome of this analysis is a first cut "Benefit-Cost Ratio". This report will discuss one particular aspect of the overall analysis; the potential of mariculture as a benefit to be derived from project implementation.

Out of necessity, the report will be superficial in its depth of analysis. A major reason for this lies in the realm of prediction. We are dealing with a relatively new field of endeavor but one which is gaining continuously in importance. The problem of predicting a dollar value in 1975 for 1995 is of particular concern and lends itself to qualitative rather than quantitative analyses.

Methodology

The introduction points the way to the problem of assessing the potential for mariculture. Hopefully, the methodology will lead to a useful conclusion. The problem will be addressed in five stages. The first stage will be to identify those species which will lend themselves to mariculture in the proposed environment (Passamaquoddy Tidal Power Project). The second stage will be to assess the

"profitability" of those species. The third stage will be to assess the expected advances in mariculture technology and the effect those advances may have on the successful culturing and resultant profit during the middle 1990's. The fourth stage will be to assess the current fisheries and their value to the region both now and in the future. The fifth stage is a summary of expected losses and expected gains.

Where factual and quantitative data is available, it will be incorporated into the assessment. Where hard data is lacking, a best estimate will be utilized and so indicated.

There are several pilot adventures into mariculture as well as Federally sponsored programs investigating techniques and feasibility of this newest form of food production. Federal, State and private firms will be queried for their knowledge. No attempt will be made at generating new data at this time.

Potential Species

There are several species which lend themselves to mariculture in one form or another. The species which have the most promise for this project are Atlantic salmon, trout, lobster, oysters, mussels and snails. These species all exist in the region and have been involved in a pilot or experimental mode for some time. The exception to this is the snail. Attempts at mariculture on this animal are not known.

There is a potential for intensified sport fishing in the form of introducing and exotic species, such as Coho or Chinook Salmon.

Estimated Success

There is very little data pertaining to the "profitablility" of the chosen species. However, pilot studies indicate that the following species can be reared and indications are that they will be profitable.

1. Atlantic Salmon - This species could be "sea-ranched" providing strains can be developed which would require less forage area than currently required. Estimates of success for this endeavor show a gross of $1,000,000 annual at 500,000 pounds. 1976 prices would be $2.00 per pound.

2. Trout - These species could be reared in holding pens or cages. Brook trout and rainbow trout lend themselves well to this method. The activity will center about a summer grow-out and has two limiting factors; the source of small fish for rearing and the number of suitable sites within the bays. Total production is not known at this time but it is not inconceivable that it could far exceed the sea-ranching of Atlantic Salmon in poundage. Prevailing value per pound is $2.00. For purposes of this analysis, an annual production of 500,000 pounds will be used. No estimate of cost of operation has been made nor has any figure been derived for initial cost of cages and fingerlings.

The production of fingerlings requires warm water and a hatchery. Solar panels with heat exchangers can produce the warm water. This

portion of the process could very well be a business in its own right. A centralized hatchery operation could supply the grow-out phase investors with their supply of fingerlings.

3. Lobster - There are conflicting points of view as to the time and success of rearing lobster. The project will create an embaymnet which may or may not provide a habitat for semiwild rearing of lobsters. More than likely, the effect of reducing tidal amplitude and warming the water during the summer will make highly sophisticated and technical plant rearing more attractive to this region. Therefore, as a result of project implementation, the way would be made easier to develop a series of rearing plants. There may be different phases of this industry developed. It is not difficult to see separate businesses and their satellites such as seed stock production, feedlot conversion, complete grow-out and scampi production. Total production per plant in the complete grow-out stage would be at least 500,000 pounds. Current wholesale prices average $1.85 and range from $1.50 to $2.25. This equates to an annual gross of $750,000 to $1,125,000. Scampi operations could be expected to repeat this in terms of pounds produced.

4. Oyster - This species has been cultured in pilot plant and small commercial establishments and annual gross values range from $100,000 to $200,000 per million oysters reared and sold. One venture reports a profit potential ranging from $30,000 to $103,000 per million sold in 1975. This was after an annual operation cost of $77,000 and an initial investment of $85,000.

Production would depend upon suitable sites for rearing and increased market demand. It is not inconceivable to expect an annual gross of $500,000. This value could dramatically increase as the demand for oysters is developed.

5. Mussel - Of all the sp-cies listed, this one is the easiest to culture. As yet in North America, this species does not have wide acceptance. There have been many attemspt at developing local markets. For various reasons, not due to the mussel, they did not succeed. There are no known values which can be assigned to this species but it definitely warrants an intensive investigation. I feel that this may be one of the better ventures in mariculture which will show a high benefit. Best estimate is a 2-3 million dollar annual gross.

6. Snails - A recent development in the fisheries of that area has provided a new potential for mariculture. The local whelk has been the target for a new industry. It is captured and prepared for market as canned escargot. This species is reported to have a high sales demand and value. Ventures into rearing this species could be varied but a grow-out form may be best. It would best work out as a satellite or ancellary business to fish production, tuilizing the remains of the prepared trout or salmon for food. The benefit to be taken for this species is not known, however, it has potential and should be seriously investigated.

Advances Expected by 1990's

Primarily advances in mariculture can be expected in development of strains of species which will grow faster under the conditions available, nutrition and marketing of products. Sources of warm water will be more sophisticated than they are now.

Another advance to be expected is the value of the project. It is becoming more and more evident that the ocean cannot supply all our needs for one reason or another. If we are to have the protein from this source, then intensive maricultural techniques will have to be applied.

Current Fisheries

Current fisheries in Passamaquoddy Bay and Cobscook Bay differ markedly in their scope and value.

1. Passamaquoddy Bay has active fisheries in herring, salmon, soft-shell clams and lobsters. The average landed value for 1973 to 1975 for each of these were as follows:

a.	Herring	-	\$393,839
b.	Salmon	-	\$ 2,000 (one year only)
c.	Soft-shell clams	-	\$ 90,333
d.	Lobsters	-	\$103,430

2. Cobscook Bay has active fisheries in lobster, clams, clamworms and groundfish such as shrimp and flounder. The most important fishery is for soft-shell clams. The value of this fishery is approximately $1,400,000. The value of the lobster fishery is $250,000 and the value of the bait worm industry is $457,000.

Summary of Losses and Gains

Values, their sources and assumptions are tabulated later in the report. In general, there will be an anticipated $2,000,000 loss for the entire project. This is divided into a $323,800 loss for Canada and a $1,666,000 loss for the U. S. The loss for the U. S. is somewhat inflated due to the nature of a worst case assumption on major fisheries.

Gains from mariculture are more speculative but estimates indicate a total annual gain will not fall below $7,500,000.

Annual Losses - Canada

Weir Losses and Reconstruction[1]	$129,000
Lobster Pound Losses[1]	450,000
Clam Processing Losses[1]	100,000
	$679,000 x 3.18[3]
Fixed Loss Total	= $2,159,000
Annual Loss at 6%[2]	129,000
Weir Maintenance[1] (Annual) $8,000 x 3.18[3]	25,500
Clam Fishery Loss[4] (Annual)	90,300
Sardine Fishery[5] (Annual)	79,000
Total Annual Losses	$323,800

(1) These values are taken from Report of the Fisheries Board in the Investigation of the International Passamaquoddy Tidal Power Project 1961.

(2) Passamaquoddy Report 1958.

(3) Inflation rate supplied by J. Callahan to convert 1958 dollar value to 1975 dollar value.

(4) A worst case loss for the clam fishery was assumed. The report (see above) indicates a ten-year loss is expected. This assumption considers a permanent loss.

(5) This value is based upon a 20% reduction in existing fisheries value. It includes a $15,000 loss for scales.

1973	$154,000	(36,991 + 332,342) x .2 =	$ 73,866
1974	58,000	(61,562 + 369,725) x .2 =	86,257
1975	59,000	(65,704 + 315,158) x .2 =	74,172
	$271,000 ÷ 3 = $90,333		$234,295 ÷ 3 = $78,100

Total = $90,333 + 78,100 = $176,400 x 8,000 x 3.18 = $200,000

There are no estimates for lost groundfish value but they would not exceed $10,000.

It is not anticipated that the lobster fishery will decline measurably.

Annual Losses - United States

Weir Loss and Reconstruction[1] $2,000 x 3.18 = $	6,400
Groundfish Loss[2]	10,000
Lobster Loss[2]	250,000
Clam Loss[2]	1,400,000
Total Annual Loss	$1,666,000

(1) This value was taken from Report of the Fisheries Board in the Investigation of the International Passamaquoddy Tidal Power Project, 1961.

(2) A worst case loss for these fisheries was assumed. The values for the fisheries were obtained from Maine Department of Marine Resources fisheries statistics.

(3) There is a viable bait worm fishery which will be adversely affected by this project. Assuming that 60% of the landed figures come from Cobscook Bay, the annual value of the fishery is $457,000, this brings a worst case loss in Cobscook Bay to over $2,000,000.

Annual Gains for Mariculture

Canada - Passamaquoddy Bay

Salmon	-	1 venture	$1,000,000
Trout	-	2 ventures	1,000,000
Oysters	-	5 ventures	500,000
Lobsters	-	2 ventures	1,000,000
Mussels	-	excellent potential	(1,000,000)
Snails	-	excellent potential	*
			$3,500,000 ($4,500,000)

United States - mainly Cobscook Bay

Salmon	-	1 venture	$ 500,000
Trout	-	4 ventures	2,000,000
Oysters	-	5 ventures	500,000
Lobsters	-	2 ventures	1,000,000
Mussels	-	excellent potential	(2,000,000-3,000,000)
Snails	-	excellent potential	*
			$4,000,000 (6-7,000,000)
Total Annual Gains			$7,500,000 (11,500,000)

*Figures not developed. Item needs further investigation. This total reflects 1975 dollar value. The number of ventures in both bays was a coarse estimate based on protection and ease of establishment of venture. It does not take into consideration the availability of the site for its intended purpose.

This value also does not include satellite industries or ancillary businesses which are developed in response to the primary industry.

It is recommended that a detailed planning study of this phase be undertaken to identify the numbers of sites available for each type of operation, the extraction of fishery statistics for analysis in terms of losses, estimation of satellite and ancillary businesses, market potential for each species and current state of the art in each species

Dr. B. E. Barrett

United States Senate

COMMITTEE ON PUBLIC WORKS

COMMITTEE RESOLUTION

RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE,

That the Board of Engineers for Rivers and Harbors, created under the provisions of Section 3 of the Rivers and Harbors Act approved June 13, 1902, be, and is hereby, requested to review the report on Passamaquoddy-St. John River Basin Power Project, Maine transmitted to Congress by the President of the United States on July 12, 1965 published as House Document No. 236, 89th Congress, and other pertinent reports, with a view to determining the current feasibility, taking full advantage of the latest technological advances, of the Passamaquoddy Tidal Power Project in the interest of providing tidal power, recreation, economic development and related land and water resources purposes.

Adopted: March 21, 1975

Jennings Randolph

Jennings Randolph, Chairman.

(At the request of Edmund S. Muskie, Senator from Maine)

ATTACHMENT NO. 10

ATTACHMENT NO. 11

LIST OF PREVIOUS REPORTS

ON THE

PASSAMAQUODDY TIDAL POWER PROJECT

1. Corps of Engineers, 1935-1936 - On May 28, 1935 under authority of the Emergency Relief Appropriation Act of 1935, funds were alloted to the Corps of Enineers for design and construction of a single-pool power development located wholly within the United States. These works were to be designed and constructed so that they could eventually be part of an international two-pool plan. The initial project consisted of generating units totaling 62,500 kw with a 30,000 kw diesel-electric auxiliary plant resulting in an electrical output of 262 million kwh a year. This project, known as the United States Plan was a single-pool scheme, resulting in intermittent and varying power output. It was not economically feasible and, lacking Congressional approval, the project was abandoned.

2. Federal Power Commission -- Report of 1941 - United States Senate Resolution No. 62, dated February 2, 1939 requested the Federal Power Commission to review all previous reports and information on the Passamaquoddy Tidal Power Project (United States Plan). The report was published as Senate Document No. 41, dated April 7, 1941, 77th Congress 1st Session. It concluded that neither

a tidal plant nor a steam-electric plant, when compared with potential river hydroelectric plants in Maine, was desirable. However, the report pointed out certain distinct advantages inherent in tidal power over conventional methods of power development and stated that the conclusions reached in the report, "...should not preclude thorough exploration of the possibilities of a large international tidal power project at Passamaquoddy by the Governments of the United States and Canada."

3. International Joint Commission -- Report 20 October 1950 On November 9, 1948 the Governments of Canada and the United States requested the I.J.C. to determine the scope and cost of the comprehensive investigation necessary to establish the engineering and economic feasibility of a proposed international development and that the cost of a detailed investigation if undertaken by the two Governments would require an expenditure of $3.9 million. Subsequent to this report, the U. S. geological Survey developed new techniques in the sonic method of underwater surveys. By direction of the President, the Corps of Engineers collaborated with the U. S. Geological Survey in conducting field tests in Passamaquoddy Bay during the summer of 1951. As a result of this latter experiment, the Corps of Engineers reported in May 1952 that the cost of the overall survey was revised downward to $3 million.

4. New England - New York Interagency Committee Report 1955 This report, an inventory of the natural resources of the northeastern region of the country authorized by the Flood Control Act

of 1950, contianed as one of its recommendations the desirability of undertaking the survey of an international tidal power development at Passamaquoddy in accordance with the details set forth in the October 1950 report of the Commission.

5. <u>International Joint Commission -- Report April 1961</u> In accordance with United States Public Law 401, 84th Congress, 2nd Session and the Boundary Waters Treaty of 1909, the Governments of the United States and Canada directed the International Joint Commission to investigate the engineering and economic feasibility of harnessing the tides of Passamaquoddy and Cobscook Bays in the Province of New Brunswick and the State of Maine for the production of hydroelectric power. The Commission appointed an International Passamaquoddy Engineering Board and an International Passamaquoddy Fisheries Board to undertake the necessary field investigation. The Fisheries Board's study concluded that construction and operation of a tidal power plant in these International waters would not adversely affect the commercial fisheries in the Passamaquoddy region. The Engineering Board found that the optimum development for tidal power would consist of a two-pool scheme with a hydroelectric plant on the Saint John River in Maine to serve as an auxiliary source of power. The combined development would have a 300,000 kw installed capacity tidal plant with a 400,000 kw installed capacity river hydro, making a total dependable capacity of 555,000 kw with an annual energy output

of slightly over 3 billion kwh at a total investment cost to the two countries of $687 million. The Commission found "...that the tidal project, either alone or in combination with certain auxiliary power sources, will not permit power to be produced at a price which is competitive with the price of power from alternative available sources." Further, the Commission recommended "...that development of the project be viewed as a long-range possibility having better prospects of realization when other less costly energy resources available in the area have been fully realized." Governments of the United States and Canada have taken the Commission report under advisement.

6. Report of the Department of the Interior -- July 1963

By letter of May 1961, the President of the United States requested the Department of the Interior to review the report of the International Joint Commission on the International Passamaquoddy Tidal Power Project and the Upper Saint John River Hydroelectric Development. The purpose of this review was to advise the President on what changes in fuel, engineering or financial costs might result in making the project economically feasible. The Department of Interior's report to the President in July 1963 recommended a 1-million kw installation for the Quoddy project and a 750,000 kw installation at the Dickey site on the Saint John River. This report found the project to be both desirable and economically feasible and further recommended that this report be used as a basis for early authorization of the project.

7. Report of the Department of the Interior -- August 1964

By directive of the President of the United States, additional studies were conducted by the Departments of the Interior and Army to supplement the July 1963 report. An Army-Interior Advisory Board on Passamaquoddy and the Upper Saint John River was formed. The Department of Interior performed studies relating to power, power transmission, marketing benefits and other economic aspects. The studies performed by the Corps of Engineers to support the engineering feasibility and soundness of the engineering structures included a geologic investigation as well as field explorations at the sites of all structural components. Preliminary designs were made of the dikes, powerhouse and other auxiliary structural features. The Corps investigation covered engineering layouts and cost estimates for various sizes of tidal power plants at Passamaquoddy and a hydroelectric development at Dickey. The report recommended that immediate steps be taken for early authorization of the International Passamaquoddy Tidal Power Project, the Upper Saint John River Developments and the Transmission System, for construction by the United States.

8. Department of the Interior Report -- July 1965

In July 1965, the Secreatry of the Interior forwarded to the President a report summarizing the August 1964 report. Included in the report were comments of interested State and Federal agencies as to the 1964 report. Each of the New England State Governors except

Rhode Island, which did not comment, endorsed the entire project. The 1965 report also reflected new power value estimates prepared by the Federal Power Commission. The power benefits used in the economic analysis in the August 1964 report were based upon power value estimates furnished by the Federal Power Commission in December 1963. The report utilized a composite power value of $27.70 per kilowatt-year and 3.0 mills per kilowatt-hour. However, on the basis of larger more economical developments by the power industry, the Federal Power Commission on February 16, 1965 furnished revised composite power values computed to be $23.50 per kilowatt-hour and 2.6 mills per kilowatt-hour. Using the new power values, the benefit-cost ratio of the Passamaquoddy Project fell below unity. Accordingly, the July 1965 report concluded that the tidal power was not economically justified. The report recommended authorization of continued study, reexamination and possible redesign of the Passamaquoddy Project taking full advantage of the latest technological advances.

9. Preliminary Economic Feasibility Study - (dated 30 November 1967 with Supplement dated 29 April 1977)

Upon receipt of a Senate Resolution sponsored by Senator Muskie of Maine and authorized funds, the New England Division, Corps of Engineers prepared a preliminary economic feasibility study to determine if tidal power in the Passamaquoddy Region was feasible under current conditions. The study reevaluated 500 and 1000 megawatt international plans and various 40 - 250 megawatt single and double-pool concepts which could be constructed entirely within the

United States. Although the primary purpose of the project is power, ancillary benefits from area redevelopment, fisheries-mariculture and recreation can be realized. The results of the preliminary study indicated that the benefit-cost-ratios for all projects evaluated were less than unity. However, at the request of Honorable James Longley, Governor of Maine, one of the projects (500 mw International Plan) was evaluated by a general "life-cycle costing" method which revealed that the project did have some merit and that further study was warranted.

10. Miscellaneous Tidal Power Reports

a. "Tidal Power Study for the United States Energy Research and Development Administration", March 1977, was prepared for ERDA by the Stone & Webster Engineering Corporation. This study reviewed tidal power possibilities on a worldwide basis, addressed the potentials in the Passamaquoddy region and Cooks Inlet, Alaska, and reported on some of the environmental concerns of tidal power.

b. "Feasibility of Tidal Power Development in the Bay of Fundy", dated October 1969, was prepared by the Atlantic Tidal Power Programming Board - New Brunswick, Nova Scotia and Canada.

11. Principal Fisheries and Environmental Studies and Reports in the Area

Report on Passamaquoddy Fisheries Investigations to the International Joint Commission was prepared by the International Passamaquoddy Fisheries Board, dated October 1959.

ATTACHMENT NO. 12

LIST OF OTHER RECENT AND/OR ONGOING STUDIES IN THE AREA

a. Environmental Impact Statement for 250,000 barrel/day oil refinery and Marine Terminal, Eastport, Maine, prepared by the U. S. Environmental Protection Agency, Region I, Boston, Massachusetts 02203, dated 13 October 1976.

b. New England Energy Situation, Alternatives for 1985, by Federal Energy Administration, Region I, Boston, Massachusetts, dated October 1976.

c. A report on "New England Hydroelectric Development Potential" by New England Federal Regional Council, Energy Resource Development Task Force, Hydroelectric Facilities Work Group, dated June 1976.

d. A report on "The Potential of Wood as an Energy Resource in New England" by the New England Federal Regional Council, Energy Resource Development Task Force - Wood Utilization Work Groups, dated September 1977.

e. Passamaquoddy Tribal Council Tidal Power Project at Half-Moon Cove, Pleasant Point, Perry, Maine. A possible small tidal power project and mariculture development may be investigated.

f. The Dickey-Lincoln School Lakes Hydroelectric Power Project in northern Maine is a Corps of Engineers authorized project in the advanced engineering and design stage. An Environmental Impact Statement was issued for public comment in October 1977.

g. Reevaluation of hydroelectric power potential under Section 167, PL 94-587, dated 22 October 1976 is being accomplished by the Corps of Engineers.

h. Hydroelectric power studies in New England are being conducted by the New England River Basins Commission.

i. Maine Comprehensive Energy Plan, 1976, prepared by the Maine Office of Energy Resources.

j. The NEPOOL Forecast for New England 1978-1987, dated 1 January 1978, prepared by the New England Power Pool.

k. United States Fish and Wildlife Service Characterization Studies along the Maine coast. (This study has not been completed but will contribute to the tidal power study).

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED-E

31 May 1977

SUBJECT: Passamaquoddy Tidal Power Project (CWIS #14023)

HQDA(DAEN-CWP)
WASH DC 20314

1. References:

a. Resolution adopted on 21 March 1975 by the Committee on Public Works, United States Senate, as sponsored by Edmund S. Muskie, Senator from Maine.

b. Public Law 94-180, Public Works Appropriations Act for FY 1976, approved on 26 December 1975, which authorized funds for subject study.

c. Letter dated 7 September 1976 from Honorable James B. Longley, Governor of Maine, recommending that a life-cycle costing analysis of the tidal power project be accomplished.

d. OFPP Pamphlet No. 1, August 1976, titled "Major System Acquisitions - A Discussion of the Application of OMB Circular No. A-109," and OMB Circular No. A-109 dated 5 April 1976 which pertains to life-cycle costing.

e. Checkpoint type meeting held in NED on 7 April 1977 during which Messrs. Baltis, Reisler and Shwaiko from Office, Chief of Engineers met with personnel of this Division to discuss the project in general.

2. Attached is copy of draft report prepared by this Division titled: "Economic Feasibility Study for International Passamaquoddy Tidal Power Project, Cobscook and Passamaquoddy Bays, Maine and New Brunswick" dated 20 November 1976; and Supplement thereto dated 30 April 1977. It is noted that this letter is not requesting a technical type review of the draft report as such but to briefly inform you of the economic feasibility of the International and All-American tidal power plans and our life-cycle analysis of the 500 MW International project. Also to request your office to review and make a decision on the applicability and appropriateness of life-cycle analysis as the economic basis for the project and to advise this Division on whether or not to proceed with further project study.

Attachment 13

NEDED-E 31 May 1977

SUBJECT: Passamaquoddy Tidal Power Project (CWIS #14023)

A separate letter dated 24 May 1977 has been forwarded to OCE, Attention DAEN-CWP-E requesting a technical type review of the report especially on the life-cycle presentation.

3. Prior to initiating a Plan of Study and full scale Survey Scope Study for subject International project, it was determined to first accomplish an economic feasibility study of the project based on updated benefits, costs and current conditions to determine if further study was warranted.

4. The tidal project is unique in principle and is considered special in that it is a one of a kind type project in the United States. As background, our task was to update construction, operations and maintenance costs and benefits of the 500 and 1,000 megawatt International Tidal Power Project as proposed in August 1964 by the Passamaquoddy - Saint John River Study Committee. This plan is basically the same as the 300 megawatt international project as proposed and presented by the International Passamaquoddy Engineering Board in October 1959 except for increased installed generating capacity. This updating task was completed in November 1976 and the economic evaluation by the conventional Benefit-Cost Ratio (BCR) method indicated that the project was not economically feasible as the BCR was less than unity. A brief summary is as follows:

Passamaquoddy
International Tidal Power Project

Project Size	BCR with Power Benefits Only	BCR with Power and Ancillary Benefits*
500 MW	.53	.74
1000 MW	.49	.67

* Includes area redevelopment, fisheries and recreation.

Based on a Total Investment Cost of $1,775,254,000 for the 500 MW facility, the average cost per KW is $3,551; and the 1000 MW plant is $2,803/KW on a Total Investment Cost of $2,802,751,000. These unit costs are very high when compared to other types of power alternatives. When analyzing the two projects from an energy production and cost viewpoint, the 500 MW facility is the more preferable and economical plan. The Total Investment Cost includes estimated Interest During Construction.

5. As the evaluation work for the international plan progressed, certain comments by state and other personnel mentioned that the 1935 tidal power project, if built and which was entirely within the boundaries of the United States, would be a "bargain" and possibly worthwhile under today's conditions. In view of this, this Division updated the costs and benefits of the original 1935 project for which construction was started but discontinued in 1936, plus other various single and double pool All-American tidal power concepts that were proposed in the 1934-1936 era. The general results of the economic study of these All-American projects when based on the conventional methods indicates a BCR range of .31 - .45 to 1.00 when only power is considered, and a BCR range of .55 - .77 to 1.00 when ancillary benefits are included. Likewise, the All-American concepts do not appear economically feasible by conventional analysis, and therefore further study does not appear warranted.

6. As noted in the report, the Honorable James B. Longley, Governor of Maine strongly suggested that the Passamaquoddy project be evaluated on a life-cycle basis, which in general takes into consideration escalation of replacements, operation, maintenance and fuel costs over the life span of the project. The Governor was advised that this was not the conventional dictated method of analysis as established by the Congress for the evaluation of water resource project, however, that this Division would develop a life-cycle study of the project for his information. The Federal Power Commission cooperated greatly and assisted this Division by furnishing power values over the 100 year life span of the project through the use of their computer program. The 500 MW international plan was selected for this analysis. The life-cycle analysis undertaken by the FPC and NED is a preliminary economic examination of the project by this method and is considered to be consistent with the preliminary stage of planning we are presently in. A thorough detailed analysis by life-cycle would require more in-depth work which would be performed at a later date if further study is decided upon. The results of our investigation of the project by life-cycle indicates that the project is economically feasible and worthwhile over the 100 year life span of the project.

Although the present initial estimated annual costs for the 500 MW tidal power project is $121,121,000 per year and the selected combined cycle private alternative plant is $55,316,000, the tidal power project will become cheaper to operate in about 20 years time. This is based on both projects being financed at 6 3/8% and an annual escalation rate of 5% and a 100 year life span. In our life-cycle studies only the power costs and power benefits were considered; area redevelopment, fisheries and recreation benefits were not introduced.

7. The NED life-cycle study did not evaluate any of the All-American concepts as in our coordination efforts with the ERDA study we stated we would evaluate the 500 MW international plan and ERDA would accomplish similar studies on some All-American plans. The ERDA study was based on changes in variable fuel costs only, a project life span of 50 years and an interest rate of 7%. Their general findings and conclusions on life-cycle costing in part are:

"The most important conclusion resulting from this study is that economic evaluations of any proposed tidal power project (or conventional hydro project) which would be built in lieu of a fossil fueled power plant should be based upon life-cycle cost analyses covering at least the economic life of the project. This is a vital concept which must be given careful consideration. The detailed economic analyses made as part of this study indicate that reasonably anticipated rises in the costs of fuel for alternative oil or coal fired steam electric plants would more than compensate for the initially high tidal plant investment costs.

The life-cycle cost analyses for a 180 MW single pool project M-3 in Cobscook Bay, plus pumped storage backup, result in levelized power costs of 122 mils/kwhr. A benefit/cost ratio of 1.0 would be achieved with either a 5.4 percent annual rise in oil costs or 5.9 percent annual rise in coal costs. The corresponding break-even points would occur in the 12th and 14th years of operation, respectively. The potential net savings in power costs over the 50 year period attributable to the tidal project would be as follows for the indicated rises in fuel costs:

Alternate Fossil Plant	Net Savings in Million Dollars		
	4% Rise	5% Rise	6% Rise
Oil Fired	424	2,481	5,616
Coal Fired	-221	980	2,934"

NOTE: . If further study is commenced this Division will accomplish a life-cycle analysis of each All-American alternative.

8. Independent and separate tidal power studies by the Energy Research and Development Administration (ERDA) with Stone and Webster Engineering Corporation as the principal contractor, and the U. S. Congress Office of Technical Assessment (OTA), are both reporting that tidal power projects in the Passamaquoddy region are economically feasible when evaluated on the life-cycle basis. These agencies are recommending that the

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project be analyzed by this method. It is also noted the ERDA report agrees with the NED report that the project is not economically feasible when evaluated by the conventional BCR method. The ERDA report was completed in April 1977 and it is anticipated that the OTA report will be completed in June 1977.

9. In summary, based on the conventional BCR method of analysis, it does not appear that further study of the International or All-American tidal power plants is warranted. However, before a decision is made to cease study, the appraisal of the project by the life-cycle method of analysis indicates certain value and worth. With respect to utilizing the life-cycle method of analysis as the recognized basis for the economics of the project and further study (i.e. preparing a Plan of Study, addressing engineering, environmental concerns and public involvement for a Survey Scope Study), it is considered necessary to obtain your decision on the subject as it involves a major departure from present policy. In view of the changing times, energy situation (estimated annual savings of 2,700,000 BBLS of oil for the 500 MW project), escalation, views of other agencies, etc., the life-cycle costing appears to have merit and deserves consideration for evaluating and determining the future of this energy oriented water resource project.

10. If decision is made for this Division to proceed with the preparation of a Plan of Study, the next foreseeable critical issue is to determine whether the International or All-American tidal power project should be studied. This will first necessitate a meeting with the Canadians to obtain their formal views and position on a joint Quoddy project and study. If Canada indicates formal disinterest in the International project then it appears that this Division would be free to study the All-American tidal power plans. Presently this Division is attempting to obtain informal opinions on the tidal power project from The New Brunswick Electric Power Commission and expect to meet with their representatives during the mid-latter part of June 1977. Your office will be advised of the results of this meeting.

11. Your review comments and decision on the above and whether this Division should proceed with a Plan of Study for a Survey Scope Report are requested as soon as possible.

1 Incl (dupe)
As stated

John P. Chandler
JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

210d

DAEN-CWP-E (31 May 77) 1st Ind
SUBJECT: Passamaquoddy Tidal Power Project (CWIS #14023)

DA, Office of the Chief of Engineers, Wash D.C. 20314 28 SEP 1977

TO: Division Engineer, New England ATTN: NEDED-E

1. We concur in your recommendation to proceed with the Plan of Study for the subject project. The Principles and Standards permit the use of life-cycle costing to the extent of projecting relative prices; however, projecting of general inflation is not permitted. There are presently no specific guidelines on projecting relative prices; any such regulation would be subject to review, findings and rule-making by the Water Resources Council.

2. Since the BCR for the subject project is significantly less than unity utilizing conventional national economic efficiency benefits, you should proceed with caution in the life-cycle analysis. In addition to economic feasibility, you should determine financial feasibility through coordination with the appropriate marketing agency. If at any point it becomes apparent that you are unable to develop a feasible project, you should terminate the study and report excess funds for revocation.

3. Before proceding further with detailed analysis, you should request a meeting with OCE to clarify issues and concepts. Arrangements for the meeting should be made with Mr. Edward Cohn, DAEN-CWP-P, telephone No. 202-693-7320. Inclosed as background for the meeting are comments and observations on the general life-cycle costing concept and on your preliminary life-cycle analysis for the subject project. The major issues are : (1) what elements of life-cycle analysis are theoretically valid; and (2) what elements of life-cycle analysis are amenable to credible and consistent measurement.

FOR THE CHIEF OF ENGINEERS:

James W. Peck

1 Incl
as

JAMES W. PECK
Colonel, Corps of Engineers
Assistant Director of Civil Works,
Atlantic

210e

DAEN-CWP-P Life Cycle Costing Passamaquoddy Tidal Power Project

DAEN-CWP DAEN-CWP-P 11 July 1977
CGEN/bk/37320

1. Purpose. The purpose of this DF is two-fold:

a. To discuss generally the concept of life-cycle costing, including role of IWR.

b. To review NED's application of life-cycle costing to the Passamaquoddy project (pp. 28-39 of "Supplement to Economic Feasibility Study . . . " dated April 1977).

2. General. A life cycle cost is the total cost of an item throughout its useful life including construction, operation, maintenance and disposal (see LCC Workbook, GSI, p. I-1).

3. Obviously, therefore a life cycle cost is in theory precisely what we mean when we use the word "cost" in a benefit-cost ratio. We take account of maintenance, operation, rehabilitation, disposal and all other items of cost.

4. Life-cycle costings varies from traditional (Corps) benefit-cost analysis in that it attempts to project unit-costs prices into the future. There are two reasons why unit costs might be expected to increase in the future:

a. Inflation. Inflation must be carefully defined. Most economists define inflation as a general increase in the price of all items due to an expansion of the money supply. The effect of (general) inflation on Corps projects was amply demonstrated by our analysis of the Red River Waterway at the request of Senator Long. However, I (and most economists) do not credit such increases as economic gains. 1/ Instead such gains are financial only. The theory is that the exact same resources (man-hours, materials, equipment) must be used, whether the project is built now or later; i.e., with today's dollars or tomorrow.

b. Shift in Relative Price. In this case one or more specific commodities rise in price relative to all other commodities. Specifically the price of one commodity increases by greater than the inflation rate. Most economists will credit such increases as economic gains. For example, if benefit x increases 10 percent a year while inflation is 7 percent a year, then 3 percent a year is an economic gain; 7 percent is financial.

5. Accordingly, the Principles and Standards (p. 85; Federal Register, 10 September 1973, p. 24821) permits accounting for relative price changes over time. However, the P&S generally discourage such projections and this is echoed in ER 1105-2-921, p. 9 ("Price levels will be those current at the time of the study . . . ").

1/ As you know, I prefer to take inflation out of the discount rate, not put it in future prices.

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6. The reason we have been reluctant to project relative prices is that it is difficult to accomplish in a creditible manner.

7. However, it may be time to reassess our reluctance in at least three areas:

a. Construction costs. Construction costs have been increasing, according to ENR, at a faster rate than general inflation (e.g., GNP deflator). This implies it is better to build sooner than later by the rate of ENR minus the rate of general inflation.

(1) CAVEAT: The other side of the sword is that we should increase our costs by the rate of relative price change to project year one.

b. Energy costs. The fuel costs for alternatives to hydropower may continue to rise relative to general inflation. In addition the Federal energy agencies have been projecting prices. Therefore, creditible shifts in prices may be obtainable. CAUTION: Pumped storage projects may suffer if fuel costs for pumping energy are permitted to rise.

c. Unique EQ. One source of relative price shifts is scarcity (or uniqueness) for which there is no substitute. Significant historical sites, wild rivers, etc. are unique and likely to become scarce. One of the problems in increasing the price of unique EQ is, of course, the lack of ability to obtain a current price to increase from.

8. Role of IWR. The basic role of IWR should be to determine whether or not we can project relative prices with credibility and confidence. A clear discussion of the available data is crucial. I have discussed this matter with A. J. Frederick and George Antle and we should be receiving a proposal from them shortly.

9. Passamaquoddy. It is impossible to tell how much of the life cycle analysis reflects general inflation versus relative price shifts in the cost of fuel for alternative modes. There are three possible reasons for the projected increase in alternative costs:

a. Relative price shifts in fuel inputs. This is a valid economic consideration.

b. Increases in construction costs of alternative plants due to inflation. This is valid according to most economists only insofar as construction inflation exceeds general inflation.

c. Impact of general inflation. This is not valid economically; it is merely financial.

At a minimum, the field should break the reasons for the increases out according to a-c above.

11. In summary, Passamaquoddy should be redone to differentiate relative price shifts from general inflation.

SECTION IV

STUDY EFFORT ALLOCATION AND SCOPE OF STUDY

SECTION IV

STUDY EFFORT ALLOCATION

AND

SCOPE OF STUDY

SECTION IV

TABLE OF CONTENTS

IV. STUDY EFFORT ALLOCATION AND SCOPE OF STUDY

A. General

This section will present the desired sequence for carrying out the overall study, the planning process to be followed, the major work items, project schedule, interaction tasks and assignments, breakdown of study costs, how the report is to be prepared and the report format.

B. Overall Study Program

The overall study program is a large undertaking which involves many man-hours of effort by private consultants, agencies at many levels and others. The General Outlines of Study Program provides a brief description of the major study items to be accomplished and will relate to the assignments of work tasks given to the study participants. In turn, the Study Schedule will indicate the timeframe that the tasks are to be accomplished during the 4 year study period. Coordination by the Study Management Team will be of utmost importance so that all phases are performed in a timely and proper sequence.

The intent of the Plan of Study is to be a flexible document and guide, however, it may be necessary to make changes during the course of the study to add study items, revise input due to funding limitations, etc.

In view that the project is in a feasibility investigative study stage, it is not planned to prepare any physical models of the project for providing or validating various assumptions or conditions

at this time. Such work will have to rely on computer and mathematical models which are available to accomplish predictive work and other data required.

C. Study Sequence

It is estimated that the overall study will take about 4 years to complete. The study will be accomplished in a progressive manner using a multi-objective planning framework, which basically contains the following three stages:

STAGE	DESCRIPTION	PERIOD
I	Preparation of Plan of Study and Reconnaissance Report	8 months
II	Development of Intermediate Plan(s)	27 months
III	Development of Final Plans	15 months

At the end of each stage there will be a review period in which necessary changes will be made and the next stage will be discussed.

D. Planning Process

The study will be accomplished in accordance with the guidelines contained in the Water Resource Council's "Principles and Standards for Planning Water and Related Land Resources" contained in Federal Register Volume 38, Number 174, Part III, dated 10 September 1973; pursuant to Section 103 of the Water Resources Planning Act, Public Law 89-80.

Three separate planning stages are involved in developing a planning report for determining the feasibility of water resource projects. These stages in sequence of accomplishment are as follows:

1. Preparation of Plan of Study (POS) and Reconnaissance Report (Stage I)

The initial planning stage defines the scope and character of the study and provides a guide to subsequent planning. Identification of issues related to resource management in the study area is emphasized. The planner defines broad planning objectives, formulates possible alternative measures for achieving the objectives and effects a tentative impact assessment and evaluation. The level of detail is general and the planning tasks draw upon a broad data base which may be more qualitative than quantitative. The products of this stage are the Plan of Study, which sets forth in general terms the study scope and management actions necessary to implement the study purposes, and a reconnaissance study which describes baseline conditions in a general way.

2. Development of Intermediate Plans (Stage II)

The intermediate stage is characterized by developing a broad range of alternatives to achieve the planning objectives without concentrating on detailed engineering or design considerations. Potential impacts of these alternative plans will be assessed and evaluated, concentrating on their significant consequences. Data should be sufficient to set forth and analyze alternative concepts of resource management options available in the study area.

3. Development of Detailed Plans (Stage III)

During the final stage, alternatives are modified and reduced in number to produce an array of feasible plans for potential recommendation. Detailed design, assessment and evaluation necessitate specific data and well-defined study assumptions. The plans must be

sufficiently detailed to facilitate effective choices and plan implementation. The basis for the technical and constitutional measures selected to accomplish resource management will be sited. A means of implementing and managing the alternatives will be specified.

Pending a justified project, the Survey Scope Study under Stage III will result in identification of a single tidal power plan (described in sufficient detail properly evaluated and coordinated through an open planning program) which can be recommended by the Division Engineer to the Chief of Engineers and the Congress of the United States for further authorization.

E. Functional Planning Tasks

There are four functional planning tasks -- problem identification, formulation of alternatives, impact assessment, and evaulation. Each task encompasses a number of specific planning activities and requires full integration of all activities. Each activity reflects the results of previous planning. While emphasis may be on a particular activity at a given point in the planning process, successful accomplishment of a planning study requires that all four tasks be addressed at each stage. The four functional planning tasks are described below:

1. Problem Identification

- Identify public concerns
- Analyze resource management concerns
- Define the study area
- Describe the base condition and dominant factors
- Project future conditions

2. Formulation of Alternatives (Alternative plans are formulated to address planning objectives)

   - Identify management measures (technical and institutional)
   - Categorize applicable measures (to non-structural)
   - Develop plans
   - Consider plans proposed by others

3. Impact Effect Assessment (Identifies and measures)

   - Categorize sources of impacts
   - Identify and trace impacts
   - Specify incidence of impacts
   - Measure impacts

4. Evaulation (Trade-off process and ranking)

   - Categorize impacts (Adverse and Beneficial and consequences)
   - Determine National Economic Development (NED) and Environmental Quality (EQ) plans
   - Determine Federal Interest
   - Application of other evaluation criteria (i.e., Benefit/Cost Rates, acceptability, effectiveness)
   - Trade-off analysis (perception of affected groups)
   - Determine basis for next reiteration

During the course of the study, the public will be invited to participate in the planning activities through Public Involvement Program.

In addition, analysis of institutions such as various levels of government, tax structures, and attitudes toward financial obligations will be made to help assure the feasibility of plans. This analysis will be carried out concurrently with other engineering and environmental tasks during the planning period.

See Figure 4, Section II for Planning Process Chart.

F. Study Schedule

The study schedule is shown on Fig. No. 14 and reflects the most realistic timing and sequence of events prescribed at this time.

In addition, Fig. 15 shows the Intensive Management schedule of special steps (milestones and checkpoints) to be taken during the course of the study.

The study is based upon anticipated annual funding as shown on Figure No. 17.

The study schedule provides for agency review periods after each stage of completion.

If during the course of the study various items of work are added, the addition and change in time will be reflected in the schedule and distributed to interested agencies and participants.

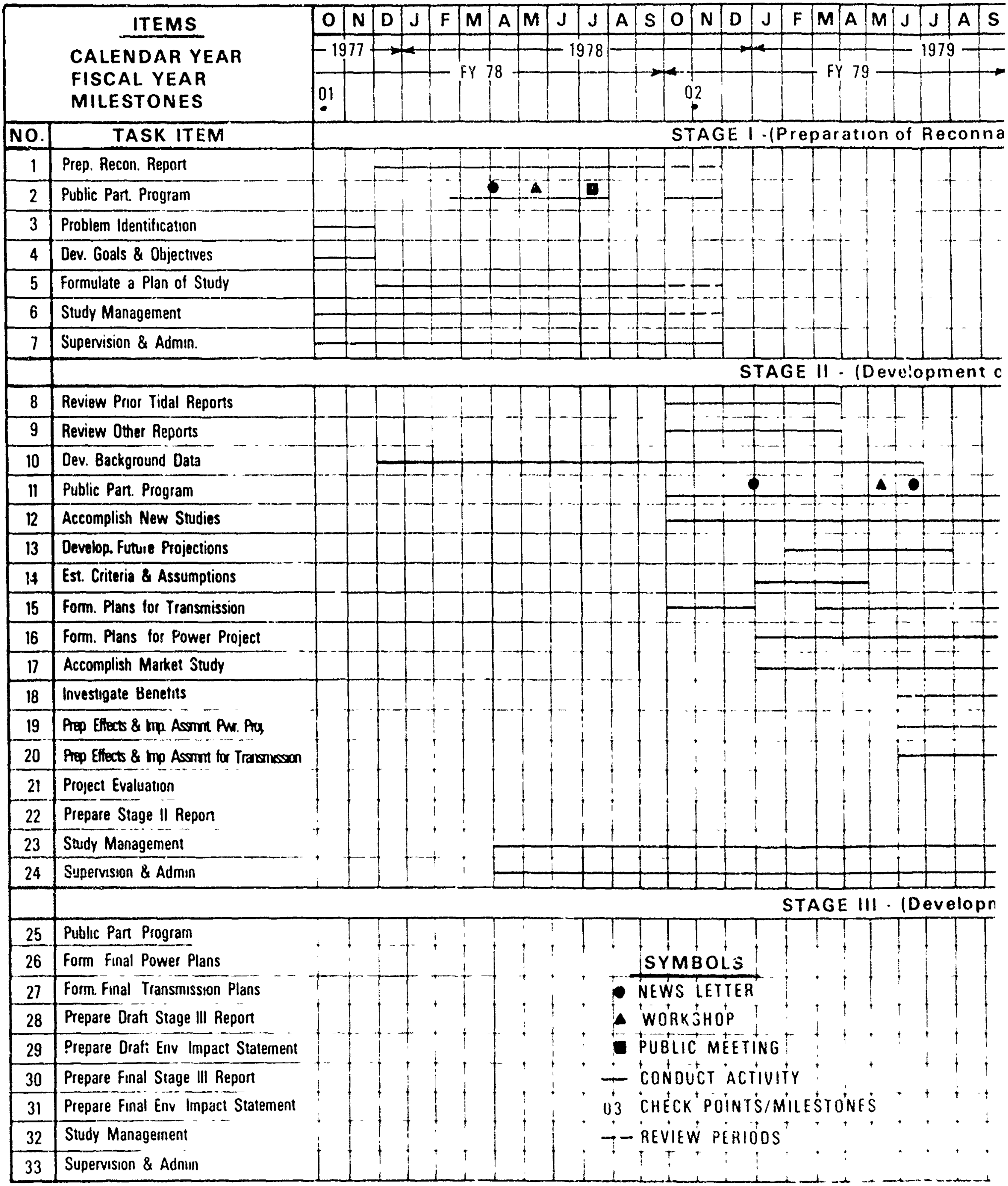
G. Intensive Management

As part of the Corps of Engineers Intensive Management Program to assure timely progress and reporting on projects, the following Table indicates the "milestone" schedule of dates when specific important events and "checkpoint" conferences are to occur for the tidal power study.

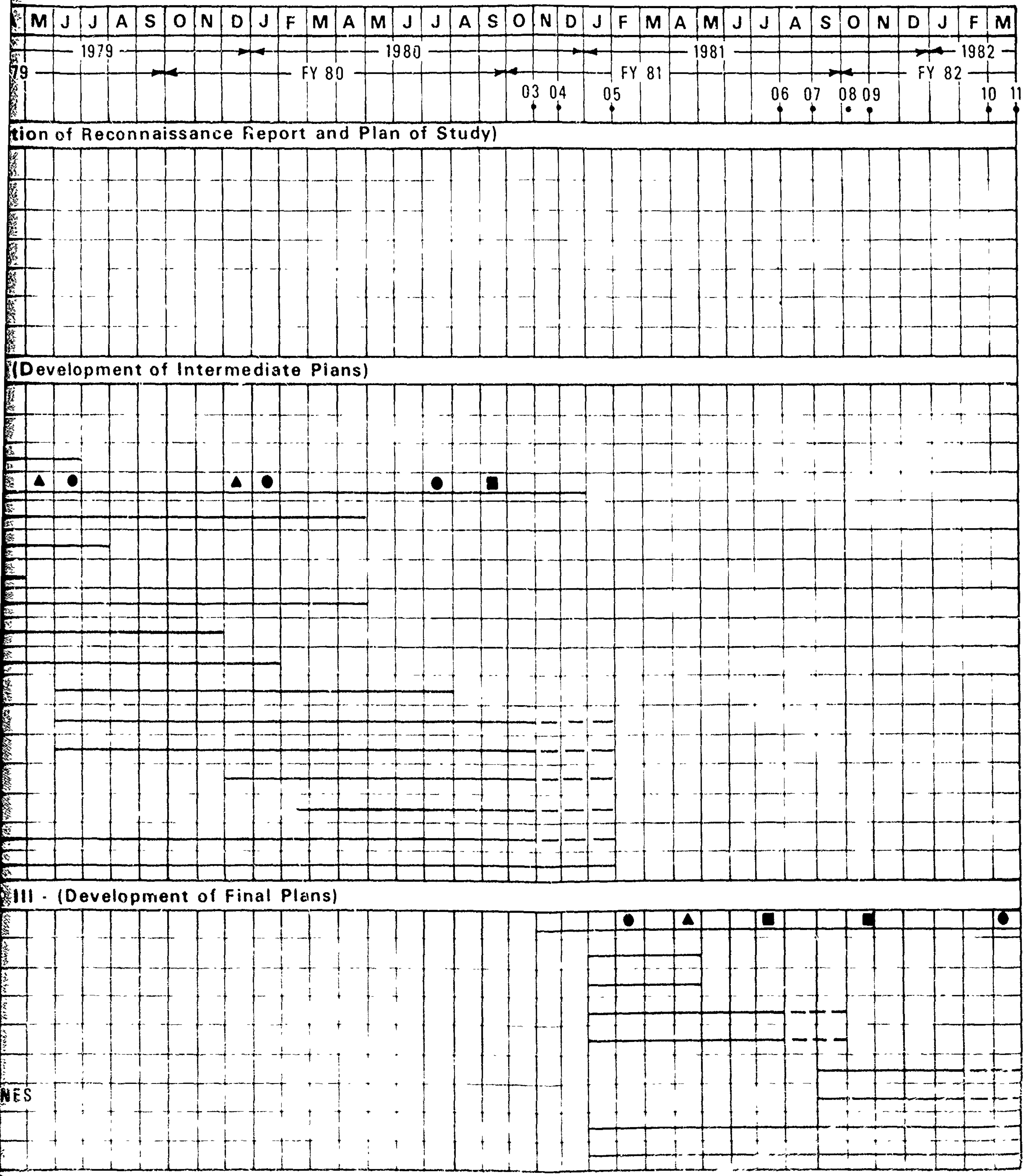
To aid in the visualization of the overall work program with respect to the time schedule, refer to Fig. 15. This time grid indicates when each work item will commence and the interrelationships involved between work items. It is of major importance that this schedule be followed to ensure a timely completion of the study.

H. Development of a Plan of Study and Reconnaissance Report

This document is the combined Plan of Study and Reconnaissance Report for the Cobscook Bay Tidal Power Study. It will serve as a guide



STUDY SCHEDULE TIDAL POWER STU



AL POWER STUDY-COBSCOOK BAY, MAINE, USA

Figure 14

FIGURE NO. 15

TIDAL POWER STUDIES

MILESTONE AND CHECKPOINT SCHEDULE

Intensive Management

Milestone Number	Title	Proposed Date
Stage 1 Planning		
01	Study Initiation. Notice of public meeting	17 Oct 1977
02	Approval of Plan of Study (POS)* by Division/OCE. Format and content of POS will be determined by the division engineers pending issuance of an Engineer Regulation. Approval authority given in EC 1105-2-78. *Includes Reconnaissance Report	31 Oct 1978
Stage 2 Planning		
03	Submission of Stage 2 Documentation to Division/OCE Documentation presenting results of Stage 2 planning (ER 1105-2-200 series). Format and content of documentation will be prescribed by the division engineer.	30 Oct 1980
04	Stage 2 Checkpoint Conference. Discussion of issues related to Stage 2 results and future study direction, Meeting held by Division and documented in Memorandum for the Record (MFR) (ER 1105-2-10).	1 Dec 1980
05	Completion of Action on MFR. Documentation of Checkpoint Conference transmitted to OCE (and division, if prepared by the district) for concurrence and/or resolution of issues discussed during the conference (ER 1105-2-10).	31 Jan 1981
Stage 3 Planning		
06	Submission of Draft Survey Report (Including DEIS) to OCE. Draft of main report and appendixes on final alternatives prior to the Stage 3 public meeting and prior to coordination of the drafts with the public (ER 1105-2-402, ER 1105-2-403, ER 1105-2-507).	31 July 1981

Milestone Number	Title	Proposed Date
07	Stage 3 Checkpoint Conference. Discussion of Stage 3 issues and adequacy of report for coordination with the public and submitted to BERH. Meeting held by division and documented in MFR (ER 1105-2-10).	1 Sept 1981
08	Completion of Action on Conference MFR. Conference MFR transmitted to OCE (and the division if prepared by the district) for concurrence and/or resolution of issues discussed during the conference (ER 1105-2-10).	15 Oct 1981
09	Coordination of Draft Survey Report and DEIS. Distribute draft report and DEIS for coordination. File report and DEIS with CEQ (ER 1105-2-507).	31 Oct 1981
10	Submission of Final Survey Report and RDEIS Division. District submits final report and RDEIS to division for action (ER 1105-2-10, ER 1105-2-402, ER 1105-2-403).	28 Feb 1982
11	Release of Division Engineer's Public Notice and Submission of Report to BERH.	31 Mar 1982

for the rest of the study. This document was prepared by the Study Management Team after public concerns were identified and coordination with other government entities was accomplished. More information regarding the Plan of Study can be found in Section II, B. The reconnaissance report is included as Section III of this document.

I. Development of Intermediate Plans

1. System of Accounts

In the planning process, the formulation and evaluation of alternatives will be based upon the Water Resource Council's (WRC) Principles and Standards and related policies. The System of Accounts (SA) will be utilized which is a display requirement and is integral to the iterative planning process. It is a planning tool which easily presents the various alternatives and compares information. The System of Accounts contains results of evaluation of the significant impacts and will show the most significant adverse or beneficial contributions of each technical alternative. In addition, the System of Accounts will include but not be limited to:

- Description of each system alternative evaluated
- Display of the planning objectives
- Presentation of each system alternatives performance against the specified evaluation criteria
- Indicate timing of project and events
- Geographical incidence (Project site, study area, region, nation)
- Uncertainty of project
- Exclusivity of project
- Actuality of situation

- Contributions toward meeting objectives
- National Economic Development (NED)
- Environmental Quality (EQ)
- Social Well-Being Aspects (SWB)
- Regional Development (RD)
- Alternative Futures and Assumptions
- Reliability
- Public Involvement and Considerations and Acceptability
- Implementation Feasibility
- Financial-Institutional Aspects
- Public Health

In preparing data for the System of Accounts, Corps of Engineers Engineering Regulations, ER 1105-2-105, ER 1105-2-921 and ER 1105-2-240 will be utilized as guidelines.

2. Range of Alternatives to be Considered

Inasmuch as the investigation and study of the potential of tidal power in the Cobscook-Passamaquoddy Bay area is to determine the feasibility of the project to produce electrical power, the nature of the project will require additional specific items to be evaluated which are peculiar to power projects. In addition to power, the tidal power project will provide other benefits such as recreation, area redevelopment and fisheries-mariculture which will be included in the analysis.

Further, tidal power is an "energy oriented" project and in view of this, the system alternatives considered will not be limited to various tidal project configuration of dams and facilities. Other alternative energy producers to satisfy the energy needs in the region

will include investigations and comparison of thermal plants, wind, direct solar radiation, utilization of wood, etc. In the evaluation of some of these special energy sources and categories, the Corps of Engineers will not enter any research type program but will evaluate the special alternatives which are reasonable on present known data and on a judgmental basis. The suggested categories for consideration and study at this time are:

Alternatives/Category	Comment
• Conventional Unused Hydroelectric Power Potential (Based on Inventory)	All new facilities (limited to Maine)
• Conventional Hydroelectric Power Plants	Updating Existing Units
• Conventional Hydroelectric Power Plants	Additions to Existing Plants
• Conventional Hydroelectric Power Plants	Low Head Type and Small Scale
• Tidal Power Plans	Single Pool in Cobscook Bay
• Tidal Power Plans	Multi-Pool in Cobscook Bay
• Fossil Fuel Plants	New Facilities
• Nuclear Fuel Plants	New Facilities
• Compressed Air and Storage	New Facilities
• Pumped Storage	New Facilities
• Solar Energy	Wind
• Solar Energy	Direct Solar Radiation
• Geothermal Energy	
• Utilization of Wood	
• Conservation and Insulation Measures	
• Load Management	

Alternatives/Category, Cont'd.

- Marketing and Pricing
- Insulation Measures
- Planning and Evaluation Criteria

3. Other Evaluation Considerations

To provide for proper comparative evaluation with various "alternative futures" of the area and region, it is proposed that uniformity of data such as the following is necessary to be included. Other items can readily be added as necessary or which are considered essential at a later date in the study period. Some of the present typical evaluation factors are:

- New Installed Capacity
- Net Annual Generation
- Type of Power (Peaking, Intermediate or Base)
- Earliest On-Line Date
- Structural Features Proposed
- Benefit/Cost Ratio
- Life-Cycle Costing Analysis and Project Optimum Scheduling
- Marketability
- Total New Investment Cost
- Environmental Impacts
- Social Impacts
- Energy Impacts on Region
- Levels of Acceptability
- Water Availability
- Return of Energy Investment

4. Alternative Future Scenarios

To make the evaluation more meaningful, four (4) "alternative futures scenarios" will be developed and considered for the various alternative energy projects to be considered. These different futures are:

- Continuation of Present Trends "without" the project (called the most likely scenario)
- The environmental, social, etc. future which would strongly influence the acceptability of the project (called the Environmental Scenario)
- Possible economic situations which could effect budgeting and/or economic conditions of the region and thus affect the project (i.e., balance of trade problems, recession, etc.) (called the Economic Scenario)
- The energy need situation where an oil embargo or similar situation would force the country to rapidly develop internal energy resources (Energy Scenario)

5. Plans Identified During the Evaluation

During the Development of Plans, a plan which produces "the best economic gains from a national point of view" shall be designated the National Economic Development (NED) Plan. The plan which causes the least impact to the environment shall be designated the Environmental Quality (EQ) Plan. All alternative energy concepts/plans investigated shall be included in the report with applicable data thereon. As an end product of the report, all alternative plans will be evaluated from all aspects including acceptability which will result in a Recommended Plan.

J. Development of Final Plans

The overall Survey Scope Level C study will develop plans for:

- A tidal power Project in Cobscook Bay

- A transmission line from the project site to the nearest feasible point of connection in the New England distribution system

Reports on the following items will be prepared:

1. Tidal Power Plan

2. Transmission Facilities Plan

3. A single Environmental Impact Statement for the proposed tidal power project and transmission line facilities.

4. A consolidated Survey Scope report containing the tidal power project transmission facilities and the environmental impact statement.

During the stages of plan development, reiteration of the alternatives for the project will be necessary to assure feasibility and acceptability of a plan.

FIGURE 16

K. Major Study Tasks With Estimated Study Costs

		Total Amount
STAGE I - Preparation of Reconnaissance Report and Plan of Study		
1.0	Prepare Reconnaissance Report	$200,000
2.0	Public Participation Program	35,000
3.0	Problem Identification	5,000
4.0	Development of Goals and Objectives	5,000
5.0	Formulation of a Plan of Study	50,000
6.0	Study Management	30,000
7.0	Supervision and Administration	30,000
	Sub-Total:	$355,000

(FIGURE NO. 16 Continued)

		Total Amount
STAGE II - Development of Intermediate Plans		
8.0	Review Prior Reports on Passamaquoddy Tidal Power Project	$ 5,000
9.0	Review Other Tidal Power Publications	5,000
10.0	Develop Background and Baseline Data	521,000
11.0	Public Participation Program	50,000
12.0	Accomplish New Studies and Investigations	370,000
13.0	Develop Future Projections	27,000
14.0	Establish Criteria and Assumptions	3,000
15.0	Formulation of Plans for Transmission Line	305,000
16.0	Formulation of Plans for Power Project	51,000
17.0	Accomplish Electric Power Marketing Study	20,000
18.0	Investigate Project Benefits for Various Plans	10,000
19.0	Prepare Effects Assessments and Impact Assessments for Tidal Power Project	86,000
20.0	Prepare Effects Assessments and Impact Assessment for the Transmission Lines	100,000
21.0	Project Evaluations	15,000
22.0	Prepare Stage II Report	48,000
23.0	Study Management	90,000
24.0	Supervision and Administration	90,000
	Sub-Total:	$1,796,000

(FIGURE NO. 16 Continued)

		Total Amount
STAGE III - Development of Final Plans		
25.0	Public Participation Program	$ 50,000
26.0	Formulate and Develop Final Plans for Power Project	275,000
27.0	Formulate and Develop Final Plans for Transmission	250,000
28.0	Prepare Draft Stage III Report on Project	54,000
29.0	Prepare Draft Environmental Impact Statement	208,000
30.0	Prepare Final Stage III Report on Project	56,000
31.0	Prepare Final Environmental Impact Statement	56,000
32.0	Study Management	90,000
33.0	Supervision and Administration	90,000
	Sub-Total:	$1,129,000
	TOTAL:	$3,280,000

NOTE: A more detailed breakdown of these costs, tasks, and responsibilities is located in Figure No. 19.

L. Description of Major Study Tasks

The study tasks are broken down by the three study stages, I, II, and III. Some items to be studied and their estimated costs are indicated on the following pages:

Stage I - Preparation of Plan of Study and Reconnaissance Report

1.0 Prepare a Preliminary Reconnaissance Report - ($200,000)

The Reconnaissance Report for the tidal power project will indicate the history of tidal power in the Cobscook Bay Region, some possible tidal power alternatives, and their estimated construction and operation and maintenance costs; economic analysis, anticipated environmental concerns and impacts, and recommendations if further study of the project should be continued.

2.0 Public Participation Program - ($35,000)

Develop and carry out a Public Involvement Plan for the Plan of Study development period.

3.0 Statement and Identification of the Problems - ($5,000)

In order to develop the Study Goals and Objectives, it is necessary to establish a Statement of the Problem. This statement must identify problems associated with energy production and needs in the state and region.

4.0 Development of Goals and Objectives - ($5,000)

The development of project goals and planning objectives will be accomplished early in the study. They will encompass and be consistent with the needs and desires of the people such as:

- Providing electrical generation to meet future needs

- Conserve national/regional resources

- Utilize natural renewable regional resource in the form of tidal power

- Reduce regional dependency on foreign fuels

- Enhancement of Economic Development in the region

The goals will serve as the basis for actual plan formulation, evaluation, and design of energy producing systems, particularly tidal power. These goals must be consistent with federal, state and regional goals and energy problems.

Planning objectives must be identified to effectively plan for and measure the performance of energy systems. Identification and ranking of the planning objectives provide a basis for evaluating the impacts and performance of alternative systems.

5.0 Formulation of a Plan of Study (POS) - ($50,000) (NED)

5.1 - The initial task or stage of the study is preparation of a Plan of Study (POS) to guide the study management team. This POS is intended to be a living and flexible document and to be revised and up-dated as needed during the planning process.

The Plan of Study includes:

a. Statement of the problem.

b. Definition of guidelines and criteria under which the study will be conducted.

c. Development of organization, management and working relationship between agencies accomplishing the study.

d. Development of work items.

e. Estimation of division of effort for major work items.

f. Detail of the cost of the work items.

g. Policy evaluation of the need for models.

h. Examination of planning criteria and guidelines.

The completed Plan of Study will be distributed to appropriate State and Federal agencies for review to ensure effective and efficient plan development. It will be distributed to appropriate civic organizations and industrial and academic representatives to ensure citizen involvement in the planning process. It will also be reviewed by representatives of the technical sector to ensure adequate scientific involvement.

For aid in visualizing the overall work program with respect to the time schedule, refer to Plate , entitled "Schedule for Cobscook Bay Tidal Power Study, Maine." This time-grid shoes not only when each major work item will commence and terminate but also the interrelationships involved between the work items. It is of major importance that this time-grid, especially the critical path items, be followed to ensure that the study is completed on schedule.

6.0 Study Management - ($30,000)

This item covers the activities required of the study team to accomplish designated management tasks, monitoring of consultant and agency input, maintaining project schedules and funding levels, and carrying out the public participation program during the Stage I period.

7.0 Supervision and Administration - ($30,000)

Work under this item includes tasks performed by supporting Corps of Engineers personnel and activities in direct relation to the tidal power study. Some of these tasks and items include supervisory guidance of the study, typical overheads, and general support during the Stage I period.

8.0 Review Prior Reports on Passamaquoddy Tidal Power Project - ($5,000)

All previously published reports on projects in the area shall be re-examined to determine whether or not previously developed concepts can be used in the study.

9.0 Review Other Tidal Power Publications - ($5,000)

A comprehensive literature search will be made and the documents located shall be reviewed to determine what technologies exist, what other tidal power studies have been accomplished and what experiences others have had.

10.0 Develop Background and Base Data for the Study Area - ($521,000)

In developing this data, the "study areas" for various aspects of the project differ considerably. For example, the economic-social investigations will encompass local, state, regional and federal areas, water quality would only involve the Cobscook Bay drainage area and other items limited to the project site only. The "project site" is considered the pool bays, construction areas, and location of proposed facilities.

Work Will Encompass

- Inventory of Land Use in the Project Area and Washington County, Maine
- Climatic Conditions
- Geotechnical Information
  - LANDSAT & Remote Sensing Studies (Incl. lineations, minerals, etc.)
  - Surficial and Bedrock Geology and Physiography
  - Seismic history
  - Establish 3 Remote Sensing Stations
  - Photogeotechnical mapping
  - Preliminary Dynamic Analysis and Seismic Surveys

- Hydrology
- Tidal information
- Water Quality Investigation
  - Riverine
  - Bay Areas
- Demographic and Economic Activity
  - Indication of Growth
    - (Population)
    - (Personal Income)
    - (Per Capita Income)
    - (Employment by Industry, Fisheries, etc.)
    - (Production by Industry, Fisheries, etc.)
    - (Miscellaneous)
  - Impacted Industries Studies
  - Area Development
  - Community - Municipal Services
  - Data on type of labor and availability
- Energy Scenario
  - Relationship between National, New England, State and Washington County
  - History of electrical generation and consumption and costs in New England and Maine
  - Types and location of existing and proposed generations facilities
  - Types of customers (preference, etc.)
  - Designate and map electrical service areas
  - Locate and show size of regional distributions systems

- Indicate type of fuels and amount consumed on an annual basis by power plants in the State of Maine

- Availability of energy natural resources in region (i.e. wood, etc.)

- Cost of various fuels in region (wholesale and retail)

- Status of proposed schedule for constructing generating facilities

- Electrical rates and composition

- Social Aspects

- Environmental Aspects

Biota

(1) (Fresh Water)

(2) (Marine)

(3) (Terrestrial)

Terrestrial Ecosystem (Including Flora and Fauna)

Aquatic Ecosystem

(Fresh Water)

(Marine)

Sampling of Fish Species

Circulation studies in the bay area

Fish and wildlife studies

Species

Endangered Species

Wildlife Habitats (quality and quantity)

Fisheries Habitat (quality and quantity)

Sampling of fish tissues

Raptor Studies

Wilderness and natural areas

Estuarine and wetlands areas

Mariculture Developments in Region

Public Health - Hygienic Aspects

Pollution

From land

Industrial air and noise

Domestic

Recreation Resources and Facilities

Natural Beauty - Scenic Area

Cultural REsources

Archeological - Cultural Sites

Historical Sites

Water bourne Transportation, routes, types, size of vessels and amount of trade

Public Roads in region

Physiography

Prepare Base Maps and Drafting

Air Quality in region

Noise Quality in region

Flood and Hurricane Storms and conditions

Existing Transmission Facilities

11.0 The Public Participation Program - ($50,000)

Development of the Program

Throughout Stage II the public will be encouraged to actively assist in the formulation and selection of alternative tidal power plans. This program will essentially entail three parts: public meeting, workshops and distribution of public information data. The public involvement program (Attachment No. 1) will be designed around seven steps, namely:

- Determine the public involvement objectives for each stage of the survey investigation
- Identify the publics
- Select the public involvement mechanism
- Commence early implementation
- Recognize constraints
- Monitor and evaluate the program

12.0 Accomplish New Studies and Investigations for Tidal Power Project - ($370,000)

In addition to reviewing and evaluating existing reports on tidal power, new studies and investigations will have to be made. These studies will include the following:

- Hydraulic Turbines of Generating Equipment and Reverse Pumping (slanted, vertical, horizontal and bulb type units)
- Describe and evaluate alternatives to tidal power for generating electricity
  - Compressed Air Storage
  - Underground Pumped Hydro
  - Conventional Pumped Hydro
  - Wind
  - Direct Solar
  - Pumped Storage

- Hydroelectric
- Nuclear Steam Cycle
- Conservation
- Load Management
- Building Insulation Programs
- Combined Cycle
- Conventional Fossil Thermal Steam
- Gas turbines
- Power purchases
- Geothermal
- Tidal Hydroelectric (including one way and two way flow)

- New Construction Methods
- Support facilities required during construction, operation. and maintenance
- Adequacy of Community Services and requirements
- Determine Labor and equipment requirement for construction
- Determine labor and equipment requirements during operational and maintenance activities
- Determine energy requirements during construction, operation and maintenance
- Conceptual designs for project*
  - Powerhouse
  - Navigational Locks
  - Earth Rockfilled Dams
  - Filling-Emptying Gates
  - Fishways

- Switchyard
- Public Highways
- Service Facilities
- Cofferdam
- Closure of barriers

- New topography (photogrammetric mapping and aerial mosaic)
- New Bathymetry
- New Resonance tidal studies

*This work is based on the premise that the previous engineering studies by the Corps of Engineers in 1935-1936 and 1956-1959 on project structures, etc. are still of value and may not require many changes. Therefore, new designs may not be necessary and the former designs are salvageable thereby reducing study costs.

- Investigation of experimental type generating facilities to include:
  - Alternate fuels (i.e. wood, bio-mass)
  - Fuel cells
  - Nuclear Fission
  - High temperature gas cooled reactor
  - Fly wheels
  - Super conducting Magnetic Storage
  - Batteries
- Power Values, for Capacity and Energy, and likely alternative determination
- Marketing Studies (SEPA)
- Transmission Line Studies (BPA)
- Sources of local construction materials

- Construction cost estimates
- Annual Operation and Maintenance Costs
- Economic Analysis Studies
  - Benefit-Cost Ratio
  - Life-Cycle Costing method and Optimum Project Scheduling
  - Economic Efficiency Test
  - Repayment
- Development of Annual Benefits
  - Power
  - Area Redevelopment
  - Fisheries-Mariculture
  - Recreation
  - Others (not accountable in water resource projects, i.e., increased tourist trade to region, etc.)
- Electrical Generation by Alternatives
- Modes of generation for project (SEPA)
- Generation Mix with Existing Electrical System (SEPA)
- Social Impacts
- Economic Impacts
- Safety Impacts of project
- Environmental Impacts
- Engineering Impacts
- Transportation Impacts
- Magnetic Surveys
- Public Health - Hygienic Impacts

- Visual - Cultural Impacts
- Historical Impacts
- Archeological Impacts
- Energy Impacts
- Real Estate Studies
  - Land required in fee for the tidal power project
  - Easements required for utilities, access roads, waterline, etc.
  - Relocation of utilities, roads, railroads, residences, fishing, weirs, etc.
  - Present ownership of lands, utilities, piers, waterline, weirs, buildings, businesses, etc. which would be affected by construction of the project
  - Ownership, costs, etc. of lands proposed for native sources of material for the project (i.e. sand, gravel, rock quarries)
  - Ownership costs, etc. for providing contractor work areas administrative, construction housing, and haul roads and construction easements
  - Appraisal, assessed and purchase costs
  - Project Boundary and Survey Markings
  - Water and riparian rights
  - Land and severance damages
  - Relocation Assistance (P.L. 91-646)
  - Project acquisition costs
  - Cemetery Relocations
  - Public Highways and Bridges
- Electrical Generation-power Studies (math model)
- Institutional Arrangements
- Financial Arrangements

- Management Arrangements
- Project Financial Feasibility
- Sedimentation and Bottom Deposit Studies
- Circulation Studies

13.0 Develop Future Projections - ($27,000)

If found economically feasible, the earliest that the tidal power project could go "on-line" and produce electricity is about 1993. This date is arrived at based on the following assumptions:

Item	Est. Year
Complete survey scope study	1981
Complete adv. eng. and design	1984
Complete construction (8 yrs.)	1992
Testing and Acceptance of Project	1993

In addition to the above dates for projecting constructions costs, potential delivery dates of equipment, etc., projections for evaluating population growths, electrical consumption, benefits-costs are required for realistic analysis.

The life span of the project is proposed to be 100 years and benefit-cost ratios will be based on this period. The project repayment from electrical revenues is based on a 50 year repayment period.

Projection for population, electrical use, etc. will be provided for the present 1978, 1980, 1985, 1990, 1995, 2000, 2010, 2020, 2030, and to 2070 and 2095 if possible.

Projections will be made for:

- Population in area
- Electrical Consumption for
  a. Residential use
  b. Industrial use
  c. Municipal/Public use
- Types of fuels to be used (Exogenous and Indigeous)
- Estimated cost of fuels & Optimum Project Schedule
- Construction costs
- Benefits from Power
- Benefits from Fisheries & Mariculture
- Benefits from Recreation
- Transmission Requirements
- Operation and Maintenance Costs
- General Inflationary rates
- Relative Inflationary rates for fuels
- Geographic market areas (SEPA)
- Environmental concerns
- Social-Economic concerns
- Discount/Interest Rates
- Alternative Futures for Maine and New England

14.0 Establish Criteria and Assumptions - ($3,000)

All existing criteria is applicable to the tidal power study shall be reviewed and examined by the study team. The criteria

shall include technical and non-technical information which the study shall be based upon.

Some examples of pertinent sources of criteria are:

- Congressional and Senatorial Resolutions
- Regional, Federal and State Energy Programs
- Applicable technical criteria documents and regulations issued by various agencies

The criteria shall be continuously reviewed for conflicts, with any conflict being referred to and resolved by higher authority as soon as possible. The study shall also include criteria as contained in the "Text of Fact Sheet on the Presidents Program issued by the White House Energy Staff" dated 20 April 1977 and adjusted to any forthcoming energy policies or programs. Based on the evaluations of technical and non-technical criteria, projections, and investigations in environmental areas, etc. a complete set of assumptions and criteria will be prepared. Principle items for which the assumptions and criteria will be established are:

- Engineering Aspects
- Environmental Aspects
- Energy Aspects

15.0 <u>Formulation of Plans for Transmission Lines (BPA)</u> - ($305,000)

The transmission lines required to transport the electricity generated at the tidal power plant to the closest point in the Maine and New England distribution system will be investigated and reported on.

The study will include an analysis of the existing distribution system, determination of corridor locations, preliminary conceptual design, evaluate different types of transmission lines, substation locations, etc. Some of the specific items for study include:

- Overhead Transmission Lines
- Underground Transmission Lines
- Direct Current Transmission Lines
- Substations
- Right of Ways for Transmission Lines

  Land Requirements

  Transmission Corridors

  Joint Utilization of R/W
- Urban Utility Tunnels
- Cost of Transmission

  Comparison between Alternatives

  Selected/Recommended Plan
- Recommendation

In addition, the feasibility of the following methods for transmitting electricity will be investigated:

Ultra High Voltage Overhead Transmission

Cryogenic Transmission

Microwave Transmission

Laser Beam Transmission

Since the size of the tidal power plants vary, different transmission lines sized with the appropriate tidal power alternative. A preliminary report for the transmission facilities will be submitted at the completion of Stage 2. Final designs for this study will be submitted at the completion of Stage 3.

Both the tidal power project and the transmission facilities will be presented to the publics and reported on together at the same times.

16.0 Formulation of Plans for the Tidal Power Project - ($51,000)

The formulation of tidal power plans with alternatives will be conducted during Stage 2. Screening of various projects will be made as well as documentation of why any are discarded during any point in the study.

Upon completion of Stage 2, the various intermediate plans developed shall be presented.

Accomplishment of Stage 3 will result in the development of final plans to include:

The Environmental Quality (EQ) Plan

The National Economic Development (NED) Plan

The "without" or "no action" plan

The Least Cost Plan

The Cost Effective Plan

The Recommended Selected Plan

2xc

All plans shall be formulated and reiterations made thereof in relation to all impacts involved.

The formulation and development of Intermediate Plans will consider the following as a minimum:

<u>All American Tidal Power Projects</u>:

- Single Pool, Plan D. with 62.5 MW
- " " 125.0 MW
- " " 250.0 MW
- Double Pool, Plan 4, with 40.0 MW
- Other tidal projects (other concepts not known at this time but to be developed (11,000)

<u>Tidal Power Projects in conjunction with</u>:

- Pumped Storage
- Compressed Air and Storage
- Development of unused low-head hydropower in Maine and New England
- Out of Area Purchase of Power

<u>Other Miscellaneous technical alternatives such as</u>:

- Wind Generation
- Direct Solar
- Geothermal Energy
- Conventional Type Plants (Combined Cycle)
- Nuclear Fuel Plants
- Conservation
- Insulation Measures
- Fossil Fuel Plant (Coal)
- Wood Utilization

The development of final plans based on utilization of tidal power (a daily renewable and predictable energy resource) will include the following:

- The "without" or "no action" plan
- Environmental Plan for Tidal Power (EQ)
- National Economic Development Plan for Tidal Power (NED)
- Least Cost Tidal Power Plan for Tidal Power
- Cost Effective Plan for Tidal Power
- The Recommended Plan for Tidal Power

It is realized that when all alternatives are considered, the Recommended Plan may not be a tidal power plan and/or be included as part of a combined power plan.

The definition of "Cost Effective" in this instance does not mean the lowest in monetary cost, but, is the most acceptable plan from a cost, economic, environmental, etc. point of view.

17.0 Accomplish Electric Power Marketing Study - ($20,000)

Accomplish a complete electrical marketing study for New England, Maine and Washington County so as to determine present and future needs of the areas. Also to determine how the tidal power project will be utilized in the future and where the market areas will be. Power marketing criteria will be developed as well as marketing consideration, power feasibility analysis and a marketing plan.

18.0 Investigate Project Benefits - ($10,000)

It is anticipated that various benefits will be derived if the final power project is constructed.

The benefits to be derived are power, area redevelopment, recreation and fisheries-mariculture.

Since power is the principal purpose of the project, the other benefits are considered ancillary and will be included in the overall analysis of benefits.

All benefits will be considred in the overall Benefit-Cost Ratio method of analysis, with a separate calculation for each of the four types of benefits.

Under the "Life-Cycle" Method of analysis, only the power benefit will be considered.

The project benefits will be evaluated for the study period (1978 - 1982), with projected benefits to 1993 (earliest project completion) and 20 years thereafter.

The project benefits to be investigated evaluated and reported on are:

Power

Area Redevelopment

Recreation

Fisheries-Mariculture

19.0 Prepare Impact and Effects Assessment for Power Project - ($86,000)

The impacts caused by the various tidal power and transmission alternatives shall be presented together as a combined assessment. However, each will be addressed separately. During the Development of Intermediate Plans, the impacts will be called Environmental Considerations as the investigations will not have been studied in full detail or completely known during the Plan Formulation period. Environmental

Considerations will be prepared and utilized in the planning and will be a source of information for developing the Ultimate Environmental Impact Statement. A reiteration of technical alternatives and the impacts will be continuously carried out so as to arrive at the final project plant.

Briefly, the Effects Assessment will determine the source of impacts, identify and trace the impacts, specify the incidnece of impacts and measure the impacts.

The general sequence of steps used in preparing an effects assessment are:

- Assemble a profile of existing conditions in the planning area;
- Extend the profile to make projections of "without project" conditions through the expected life of the project;
- Make "without project" projections, identifying causative factors and tracing their effects for each alternative;
- Identify significant effects;
- Describe and display each significant effect;
- Evaluate adverse and beneficial effects;
- Consider project modifications where adverse effects are significant;
- Seek assessment feedback from other sources;

(Steps 1-8 are common to each iteration of the effect assessment process)

- Use effect assessment in making recommendations;
- Prepare a Statement of Findings
- Use effect assessment in preparing the Environmental Impact Statement.

This sequence is discussed in more detail in the paragraphs that follow.

The environmental considerations and impacts and effects assessment will include but not be limited to investigation of the following items for with/without projects, short-long terrm, Pre-During and After Construction Completion of the project:

- Baseline Information
- Future Projections
  - Alternative Futures
  - Dominant Factors
- Engineering Impacts
  - Project Layout
  - Tidal Pools
  - Project Structures
  - Costs
- Project Benefits
- Project Economic analysis
- Financial Arrangements
- Management Arrangements
- Institutional Arrangements
- Marketing Arrangements (SEPA)
- Economic Effects (regional and national economic development)
- Social Effects (social well being)
- Environmental Effects (environmental quality)

- Public Health and Hygienic Impacts
- Aesthetic - Visual Impacts
- Archaeological - Cultural Impacts
- Energy Resources - Conservation Impacts
- Analysis of Public Opinion
- Miscellaneous for tidal project such as:

  Safety

  Real Estate

  Electrical Industry (SEPA)

  Land Use

  Transportation

  Community Services

  Labor Force

  Geological-Physical Environmental Effects

  Tidal Resonance Effects

  Fish and Wildlife (FES, NMFS, COE)

  Section 404 Evaluation

  Disposal of Surplus Excavated Materials

20.0 Prepare Impact and Effects Assessment for the Transmission Facilities (BPA) ($100,000)

The environmental considerations and impact and effects assessment for the transmission line will investigate the following as a minimum:

- Engineering Impacts
- Financial Arrangements

- Management Arrangements
- Interface with other distribution lines
- Use of wheeling
- Public Acceptability
- Environmental

  Soils-Erosion

  Air Quality

  Water Quality

  TV and Radio Reception

  Vegetation

  Fish, Wildlife, and Birds of Prey

  Landscape Quality-Aesthetics

  (Visual-Cultural)

  (Design)

  (Alignment)

  Public Safety

  Aviation

  Property Ownership

  Other utilities and highways

  Forest Managements

  Overhead-Underground Transmission Lines
- Social Economical

  Construction

  Operation and maintenance

  People affected

  (Construction Workers)

  (Local Inhabitants)

(Others)

During Construction

(Employment)

(Housing)

(Transportation)

During Operations and Maintenance

(Employment)

(Housing)

(Transportation)

Business Income and Employment

(During Construction)

(During Operations and Maintenance)

Effects on Individuals

(Change in supply of goods and services)

(Change in Property Values)

Change in Taxes

Public Expenditures

(Construction of lines)

(Operation and Maintenance of Lines)

Recreation

21.0 <u>Project Evaluation</u> - ($15,000)

The last step of the planning process is evaluating the project alternatives plans for meeting the area needs. It also includes an evaluation of the study itself to determine if the investigation of each plan was adequate. The evaluation will take place during the 3 stages of planning and become more detailed as

the study progresses. Major criteria items to be considered in project evaluation are:

- Acceptability
- Certainty
- Completeness
- Effectiveness
- Efficiency
- National Economic Development Analysis
- Planning Space
- Reversibility
- Stability

In evaluating the study, questions similar to the following should be addressed:

- Is the level of detail adequate for selection of a recommended plan?
- Do the alternatives meet the needs and objectives?
- Does the resource capability compared with the alternatives suggest that the nees being considered are erroneous or need modification?
- Has public policy changed, significantly so as to change the objectives?
- Has additional information on resource capabilities on the technical aspects of alternatives become available?

22.0 Prepare Stage II Report ($48,000)

This item includes the costs and efforts incurred with writing, editing, typing and preparing the Stage II Report - Development of Intermediate Plans.

Also included is the necessary preparation of illustrations to support the text, reproduction, and distribution of the report for information and technical reviews by interested agencies and the public.

The report will be prepared in final form and all review comments shall be included as an appendix for considereation and incorporation into the Stage III phase.

23.0 Study Management - ($90,000)

This item covers the activities required of the study team to accomplish designated management tasks, monitoring of consultant and agency input, maintaining project schedules and funding levels and carrying out the public participation program during the Stage II period.

24.0 Supervision and Administration - ($24,000)

Work under this item includes tasks performed by supporting Corps of Engineers personnel and activities in direct relation to the tidal power study. Some of these tasks and items include supervisory guidance of the study, typical overhead, and general support during the Stage II period.

STAGE III - DEVELOPMENT OF FINAL PLANS

25.0 Public Participation Program - ($50,000)

The public participation program during this stage will concentrate on the final plans selected for presentation in the final report.

During this stage final stage workshops and public meetings will be conducted as well as dissemination of informational data on the project.

The tidal power and transmission facilities will be presented to the public at the same time as a combined total project.

26.0 Formulate and Develop Final Plans for Power Project - ($275,000)

This third phase item will present final project plans which will include the Environmental Quality (EQ) Plan, the National Economic Development Plan, the Least Cost Plan, the Cost Effective Plan*, and the Recommended Plan. Also, included will be the comparative data on the "most likely selected alternative" to the tidal power project (i.e. Combined Cycle Plant).

Formulation data and engineering design concepts will be prepared in more detail than that for alternatives presented in Stage II - Development of Intermediate Plans.

*The plan which most closely meets the environmental, economics, institutional, public acceptance, etc. requirements.

27.0 Formulate and Develop Final Plans for Transmission ($250,000)

Under this item of work the following plans will be presented: Environmental Quality (EQ), National Economic Development (NED), Least Cost, Cost Effective Plan, and the Recommended Plan.

The data presented for these plans will also be in greater detail than for Stage II.

28.0 Prepare Draft Stage III Report on Project - ($54,000)

This report will be a typewritten report presenting the full results of the study and will be as close to the final product as is possible. The tidal power and transmission facilities will be reported

together as a single project. The report preparation will be coordinated by the Study Management Team and will include inputs from various agencies and consultants. The Corps will be responsible for the final typing, printing and distribution of the report for information and technical reviews.

29.0 <u>Prepare Draft Environmental Impact Statement (EIS) - ($208,000)</u>

The Draft EIS will be based on the Recommended Plan for the tidal power project and transmission facilities.

Concurrently, a separate document on Section 404 Evaluation for the project will be prepared and included in public presentations.

The draft EIS will be printed by the Corps of Engineers and distriubted for information and technical reviews by applicable agencies and publics.

The Corps will be the lead agency in the preparation of the EIS and responsible for proper coordination with all agencies and publics.

30.0 <u>Prepare Final Stage III Report on Project - ($56,000)</u>

This final report will be an extension of the draft report with the additions, corrections, public and technical review comments, included therein.

The Corps will be responsible for the preparation, printing, and distribution of the final report.

31.0 <u>Prepare Final Environmental Impact Statement - ($56,000)</u>

This final EIS will be an extension of the draft EIS with all additions, corrections, public and technical review comments included therein.

The final EIS will be printed by the Corps and distributed to appropriate agencies and publics.

32.0 Study Management - ($90,000)

This item covers the activities required of the study team to accomplish designated managment tasks, monitoring of consultant and agency input, maintaining project schedules and funding levels and carrying out the public participation program during the Stage III period.

33.0 Supervision and Administration - ($90,000)

Work under this item includes tasks performed by supporting Corps of Engineers personnel and activities in direct relation to the tidal power study. Some of these tasks and items include supervisory guidance of the study, typical overhead, and general support during the Stage II period.

M. Description of Reports

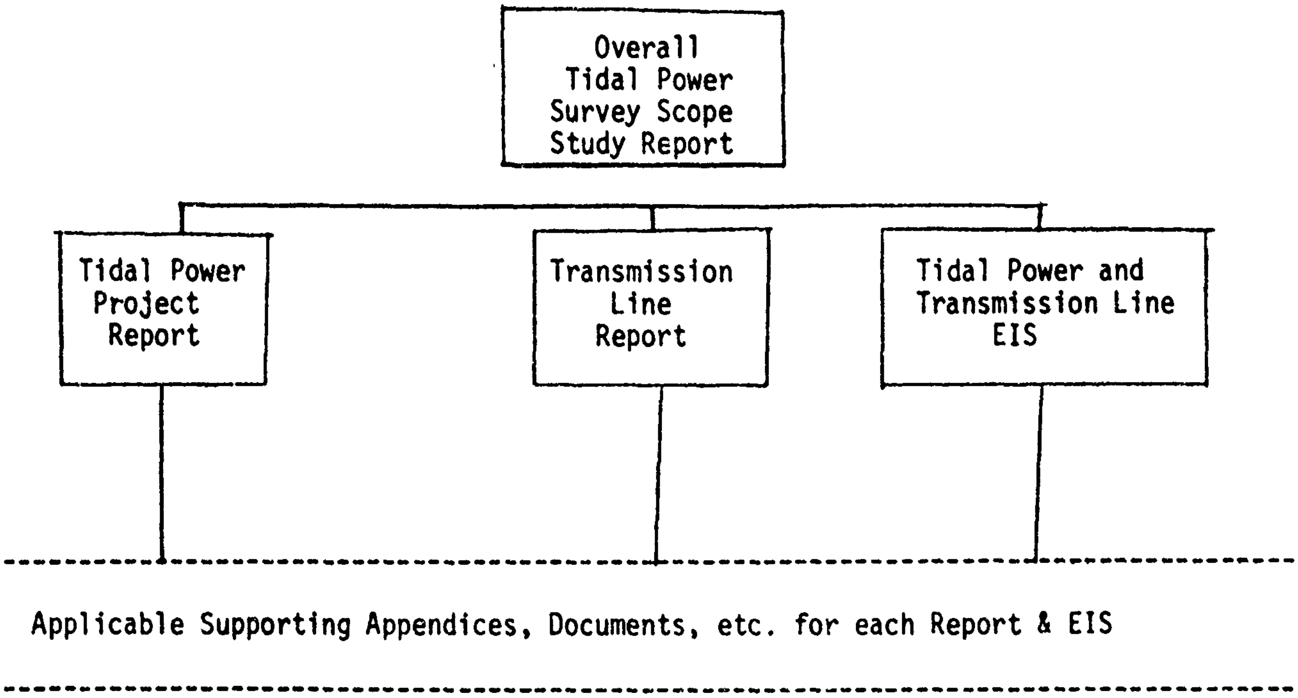
A preliminary report shall be prepared and distributed for review upon completion of Stage II, Development of Intermediate Plans, as well as a final report upon completion of Stage III, Development of Final Plans.

1. General - The resulting report for the entire study effort will be a Survey Scope Report (Level C), Survey Investigation, which is in response to an Act of Congress or a resolution of the House or Senate Committees on Public Works. In this instance, the tidal power study and report is based on a resolution sponsored by Senator Edmund S. Muskie.

The total overall project and report includes two construction elements which will be studied concurrently and prepared separately. The elements are the tidal power project and the transmission line which, although studied separately, will be contained in the same overall report. The assessment, evaluation and draft Environmental Impact Statement (EIS) for the tidal power project and transmission line will also be prepared and included in the same overall report. It is intended to complete and submit the draft EIS with the Survey Scope report. The following chart illustrates the major parts of the report.

2. Survey Scope Report for the Tidal Power Project - The Survey Scope Report for the tidal power project will be principally prepared by the Corps of Engineers and the study team.

The following chart illustrates the major parts of the Draft and Final Report



3. Report Arrangement - The report for the project will be presented in the following documents:

Proposed Survey Scope Report and Appendices
for
Stage II - Development of Intermediate Plans

- Executive Summary (10 - 20 Pages)
- Main Report (150 Pages)
- Appendices

Section A - The Study and Report

Section B - Resources and Economy of the Study Area and Region

Section C - Energy and Power Problems and Needs in the Area

Section D - Formulation of the Plan

Section E - The Selected Plans (EQ, NED, Cost Effective)

Section F - Economics of the Selected Plan

Section G - Division of Plan Responsibilities

Section H - Assessment and Evaluation

Section I - Comments and Response on Project

Section J - Public Participation Program

NOTE: Supporting Sub-Sections of the Appendices will be similar to final report.

Proposed Final Survey Scope Report and Appendices
for
Stage III - Development of Final Plans

- Executive Summary (10 - 20 Pages)
- Main Report (150 Pages)
- Appendices

Section A - The Study and Report

Section B - Resources and Economy of the Study Area and Region

Section C - Energy and Power Problems and Needs in the Area

Section D - Formulation of the Plans

Section E - Tidal Power Plans and Alternatives

Section F - Economics of the Plans

Section G - Division of Plan Responsibilities

Section H - Environmental Impact Statement

Section I - Comments and Responses on Project

Section J - Public Participation Program

Sub-Sections will be provided as separate documents, as necessary, to support the main section appendices. Some of the sub-sections may be too large to place in the main appendices. Typical Sub-Sections are:

1 - Background Data on the Study Area

2 - Economic-Social Impacts

3 - Environmental Impacts - Terrestrial

4 - Environmental Impacts - Aquatic

5 - Water Quality Investigations

6 - Visual-Cultural Impacts

7 - Tidal Resonance

8 - Hydrologic and Hydraulics Data

9 - Observation and Prediction of Tides

10 - Tidal Power Plant and Corrosion Prevention

11 - Auxiliary Power Developments

12 - Real Estate

13 - Relocations

14 - Public Highways

15 - Turbines and Generating Equipment

16 - Powerhouse

17 - Switchyard

18 - Filling and Emptying Gates

19 - Fishways

20 - Navigation Locks

21 - Channel Excavation

22 - Tidal Dams and Cofferdams

23 - Service Facilities and Operating Staff

24 - Cost Estimates of Alternatives

25 - Annual Costs and Benefits

26 - Economic Analysis of Project

27 - Transmission Line

4. Preparation of Text Material and Illustration - The Executive Summary, Main Report and Appendices A-G will be written and prepared by the "Corps" study team. The sub-sections of the various appendices will serve as the source, supporting document, and back-up material for the principal report elements. The various sub-sections will be written and prepared separately by the individual consultants, agencies, and personnel assigned to accomplish the special investigations and data. Upon completion of these sub-sections, the Corps Study Team will organize them into an orderly sequence so they can form part of the overall report.

All report elements will be prepared continuously from the outset of the study and/or initiation of the special investigations. Writing

of the report sections shall not be delayed until the end of the study and/or immediately prior to submission dates of the preliminary draft and final reports for the study.

The organization which prepares the sub-sections shall be responsible for prepareing adequate graphs, tables and illustrations for the subject presentation.

A preliminary report shall be prepared for review at the completion of Stage II (Intermediate Plans); and a final report shall be prepared at the completion of Stage III (Final Plans).

5. Typing the Report - The typing of the Summary Report, Maine Report and Appendices shall be the responsibility of and accomplished by the Corps of Engineers. This includes the Environmental Impact Statement for the tidal power project.

All separate reports and/or Sub-Sections shall be typed in draft and final form by the consultant, agency and individual assigned to accomplish the specific tasks.

It is preferred that all typing be accomplished utilizing "letter gothic" type. Further, that the typed paper size be white bond, 8 x 10½". Marginal spacing shall comply with the following:

Top	-	1¼"
Bottom	-	1½" (allowance for page no.)
Left Margin	-	1¼" (allowance for binding)
Right Margin	-	1"

All drafts of the report shall be typed double-space and final reports shall be typed single-space.

The quality of the typing shall be clear and legible for printing the reports by offset and quick copy reproduction methods.

6. Environmental Impact Statement for the Tidal Power Project - The Environmental Impact Statement (EIS) will be prepared in accordance with applicable guidelines. The Corps of Engineers, New England Division, will be the lead agency and responsible for preparing the EIS for the tidal power project.

Environmental considerations will be integrated with the planning process for the tidal power project including the open planning program.

Draft and final EIS information will be distributed for interested agency review and comment. The final EIS will be completed and submitted with the project Survey Scope Report.

The DOE will assist and provide major input in the preparation of the transmission lines aspect of the EIS.

7. Report Arrangement - The Environmental Impact Statement for the Tidal Power Project will be a separate document. The body of the statement will contain nine (9) separate sections, namely:

- Cover Sheet
- Summary
- Table of Contents
- Purpose and Need for Action
- Alternatives Including Proposed Action
- Environmental Consequences

- Affe ed Environment
- List of Preparers
- List of Agencies, Organizations, and Persons to whom Copies of the Statement are sent
- Index
- Appendices

Various supportive appendices will be made part of the overall Environmental Impact Statement. This data will be prepared by various private consultants, agencies and individuals. Attachment 3 to the Plan of Study is an initial list of items which will be addressed in accomplishing an assessment and EIS for the project.

8. Preparation of the Text Material for Tidal Power Project EIS - The Environmental Impact Statement and necessary attachments will be written and prepared by the Environmental Analysis Branch, New England Division, in coordination with the reviews by the Division Counsel.

9. Typing the Environmental Impact Statement - See data written for typing of the Tidal Power Project Report.

10. Survey Scope Report for the Transmission Line - All engineering work pertaining to the investigation, determining alternatives and selected plan of a High Voltage Electrical Transmission Line from the tidal power project site to the nearest feasible point of connection to the New England grid system shall be performed by the Department of Energy (DOE). Funds will be sub-allocated by the Division Engineer, New England Division, to the Department of Energy to accomplish the work.

The DOE will prepare a complete typewritten report on the findings and results of the study and furnish same to the Corps of Engineers. The DOE will carry out a public participation program to determine the public interest in transmission corridor locations, etc.

The report shall include data for economic analysis of the transmission lines, annual costs, financing, etc. so that the economic feasibility of the overall project can be determined.

The Corps of Engineers shall be responsible for printing the report in large quantities and distributing it for review with the tidal power project.

The Corps of Engineers will include the transmission report as a companion document which will become part of the tidal power report.

11. Environmental Impact Statement for the Transmission Lines - The EIS for the Transmission Lines will address the similar points as the tidal power project. Since the Department of Energy has legislative responsibility for determining transmission facilities, the assessment, evaluation and the EIS aspects of the transmission lines will be prepared by the Department of Energy by a sub-allotment of funds from the Corps of Engineers, New England Division.

The DOE, in coordination with the Corps of Engineers, will conduct a public involvement program for the transmission EIS as necessary.

However, at early, mid and late stage public meetings, it is planned to present the tidal power and transmission line projects and their respective EIS aspects all together at the same meeting. This will afford the public the opportunity to receive information on the total project at one time and to offer constructive comments on the project as a whole. Both the tidal power project and the transmission line EIS aspects will be combined into and presented as a single EIS with the final project report.

12. Printing of Reports - Reports to be prepared by consultants, other agencies and in-house New England Division groups shall be printed and submitted by the preparer in the number of copies specified in the Scope of Work prepared by the Study Management Team.

The main report and appendices of the overall tidal power and EIS shall be printed by the Study Management Team. This will include draft copies of the report for reviews and subsequent final reports. The report shall be printed by the Corps in sufficient quantities to permit proper technical reviews, and distribution of the report.

13. Payment for Printing of Reports - Draft and final reports prepared by consultants shall be printed and paid for by the consultants and will be included in the contract fee.

Printing of draft progress and final reports of the tidal power project required for review and larger distribution to agencies and the public will be paid for by the Corps of Engineers.

The printing costs of draft reports for the transmission lines and its EIS shall be bourne by the agency preparing the data

(Department of Energy). The printing of the final transmission line report and its EIS work will be paid for by the Corps of Engineers.

The anticipated costs to be incurred by the Corps of Engineers is listed under Reproduction Costs in the project budget.

14. Distribution of the Report - The overall tidal power report, transmission lines report and EIS will be distributed to reviewing agencies and interested publics by the Corps of Engineers.

15. Agency Review and Comments on the Report - The project schedule provides for review periods by appropriate agencies and others of the reports. At the completion of any progress and draft report or appendix, the report will be forwarded to the agencies for their applicable technical, and administrative and regulatory reviews and comments. The comments are to be returned to the Study Management Team which will advise the preparer of the report to address and respond to the review comments and incorporate same into the report.

All disputes or disagreements on comments shall be referred to the Study Team for joint resolution.

All review comments should be in writing.

16. Report Approvals - The Corps of Engineers Contracting Office reserves the right to approve/disapprove data and reports prepared by consultants under contract to the Corps.

Copies of the final tidal power study report including the transmission lines, and the total environmental impact statement shall be forwarded to Corps higher headquarters, appropriate coordinating agencies and others as required, for their approval and/or comment on the project and reports by the New England Division.

Copies of the agency approvals and/or comments will be incorporated into the final project report.

N. Study Management, Supervision and Administration - The work involved under this item is basically the tasks accomplished throughout the study by the Corps' Study Management Team.

Supervisional administration efforts have no specific work tasks associated with them.

O. Breakdown of Study Costs

General - The variety of items to be studied have been reviewed and a cost estimate to accomplish the tasks has been prepared. The tasks and costs have been planned based on anticipated funding by fiscal years.

The presentation of cost data for studies is often desired by others in different formats. Included herein as Attachment 2 are four separate presentations, namely:

- General Cost Breakdown (Figure No. 16)
- Estimated costs based on Anticipated Fiscal Year Funding (Fig. 17)
- Study Cost Estimate (PB-6) (Figure No. 18) - Which breaks the costs down by three (3) planning stages and major study categories
- Detaile work and task assignments (By Stage) (Figure No. 19)

Due to possible changes in funding, the work schedule will be altered when required.

ITEM	FY 1976 & T.Q.	FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	TOTALS
Anticipated Funding	125.0	339.0	30.0	610.0	860.0	860.0	456.0	3280.0
Cumulative	125.0	464.0	494.0	1104.0	1964.0	2824.0	3280.0	3280.0
Percent of Funding	3.8	10.3	0.9	18.7	26.2	26.2	13.9	100.0
Estimated Project Period by Stages		STAGE 1		STAGE 2			STAGE 3	
Estimated Project Costs by Stages		355.0		1796.0		1129.0		

STUDY STAGES

Stage 1-Prepare Reconnaissance Reported Plan of Study (POS)
Stage 2-Development of Intermediate Plans
Stage 3-Development of Find Plans

PLAN OF STUDY

TIDAL POWER STUDY

COBSCOOK BAY, MAINE

ANTICIPATED FISCAL YEAR FUNDING

Figure No. 17

RCS:

STUDY COST ESTIMATE (PB-6) ($000) For use of this form, see ER 11-2-220	APPROPRIATION TITLE: General Investigations	NAME OF STUDY: Cobscook Bay Tidal Power - (Passamaquoddy)
	CATEGORY: Surveys	
	CLASS: Special Studies	SUBCLASS:

LINE NO.	SUBACCOUNT		CURRENT FEDERAL COST ESTIMATE				PREVIOUS FEDERAL COST ESTIMATE AND DATE APPROVED	REMARKS
			ACCOUNT			TOTAL	(1 July 78	
	NUMBER	TITLE	STAGE 1	STAGE 2	STAGE 3			
	a	b	c	d	e	f	g	h
1	.01	Public Involvement	35	50	50	135		
2	.02	Institutional Studies	1	20	32	53		
3	.03	Social Studies	2	40	15	57		
4	.04	Cultural Resource Studies	1	30	10	41		
5	.05	Environmental Studies	15	135	89	239		
6	.06	Fish & Wildlife Studies	6	203	231	440		
7	.07	Economic Studies	2	100	26	128		
8	.08	Surveying & Mapping	5	40	5	50		
9	.09	Hydrology & Hydraulic Investigations	5	80	100	185		
10	.10	Foundations & Materials Investigations	8	127	35	170		
11	.11	Design & Cost Estimates	-	70	33	103		
12	.12	Real Estate Studies	-	25	10	35		
13	.13	Study Management	30	90	90	210		
14	.14	Plan Formulation & Evaluation	5	155	15	175		

DATE PREPARED	DIVISION	REGION	
15 Sept 1978	NEW ENGLAND	1	Page 1 of 2
	DISTRICT	BASIN	

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Figure No. 18

RCS:

STUDY COST ESTIMATE (PB-6) ($000) For use of this form, see ER 11-2-220	APPROPRIATION TITLE: General Investigations	NAME OF STUDY: Cobscook Bay Tidal Power (Passamaquoddy)
	CATEGORY: Surveys	
	CLASS: Special Studies	SUBCLASS:

LINE NO.	SUBACCOUNT		CURRENT FEDERAL COST ESTIMATE				PREVIOUS FEDERAL COST ESTIMATE AND DATE APPROVED	REMARKS
			ACCOUNT			TOTAL	(1 July 78)	
	NUMBER	TITLE	STAGE 1	STAGE 2	STAGE 3			
	a	b	c	d	e	f	g	h
1	.15	Report Preparation	5	53	20	78		
2	.20	Tidal Influence Studies	-	40	48	88		
3	.21	Recreation Studies	3	23	10	36		
4	.22	Preliminary Economic & Engineering Feasibility Studies	200	-	-	200		
5	.23	Power Marketing Studies	1	56	63	120		
6	.24	Transmission Studies	1	266	107	374		
7	.25	Transmission - Environmental	-	103	50	153		
8	.31	Supervision & Administration	30	90	90	210		
9								
10		TOTALS	355	1,796	1,129	3,280		
11								
12								
13								
14								

DATE PREPARED	DIVISION	REGION	
15 Sept 1978	NEW ENGLAND	1	Page 2 of 2
	DISTRICT	BASIN	

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PLAN OF STUDY

DETAILED WORK TASKS & ASSIGNMENTS

for

TIDAL POWER STUDY

COBSCOOK BAY, MAINE, USA

Figure 19

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

*See last page for explanation of abbreviations.

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES *					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
	STAGE I (Formulation of Reconnaissance Report and Plan of Study)	-	-	-	-	-	355,000
-1.0	Prepare Reconnaissance Report	X	FERC	X	EAB, ESAB	ENG. DIV., SMT	200,000
2.0	Public Participation Program	X		X		PAO, SMT	35,000
2.1	Conduct Workshops and Meetings	X		X		PAO, SMT	(25,000)
2.2	Prepare Brochure & Information Material	X		X		ENG. DIV., PAO, SMT	(10,000)
3.0	Problem Identification	X			Public	SMT	5,000
4.0	Development of Goals and Objectives	X	DOE		State of Maine	SMT	5,000
5.0	Formulation of Plan of Study	X	N M F S US F & WS BPA			SMT and EAB	50,000
6.0	Study Management	X				WCB, EAB ESAB, SMT F&M	30,000

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES: CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
7.0	Supervision and Administration	X				NED	30,000
	Sub Total for Stage I						355,000

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
	STAGE II - DEVELOPMENT OF INTERMEDIATE PLANS	-	-	-	-	-	-
8.0	Review of Prior Reports on Passamaquoddy Tidal Power	-	-	-	-	WCB EAB SMT - ESAB	5,000
8.1	1936 All American Tidal Power Report	X	X	X		SMT	(1,000)
8.2	1959 International Fisheries Report	X	X	X		EAB	(500)
8.3	1959 International Engineering Report	X	X	X		SMT	(500)
8.4	Review Project Benefits	X	X	X		ESAB	(1,000)
8.5	Review 1963, 1964, 1965, 1977 Reports	X	X	X		SMT	(2,000)
9.0	Review of Other Tidal Power Studies and State of the Art	X	X	X		SMT	5,000
9.1	Review and Summarize Reports on other Tidal Power Projects	X	X	X		SMT	(1,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
9.2	List existing and proposed tidal power projects. (Include location, size, and other pertinent data.)	X		X		SMT	(1,000)
9.3	Present State of the Art for Tidal Power	X		X		SMT	(1,000)
9.4	Prepare Bibliography on tidal power technical, environmental, and economical aspects	X		X		SMT	(1,000)
9.5	Environmental Aspects	X	X	X		EAB	(1,000)
10.0	Develop Background and Baseline Data	X	X	X		EAB WCB SMT	521,000
10.1	Inventory of Land Use	X	X	X		ESAB	(5,000)
10.2	Climate Conditions	X	X	X		WCB	(1,000)
10.3	Geotechnical Information	X		X		F&M	-
	a) LANDSAT & Remote Sensing Studies	X		X		F&M	(15,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
10.3	b.) Physiography-Geological Surficial and Bedrock Geology	X		X		F&M	(15,000)
-	c.) Seismic History	X	WES			F&M	(5,000)
	d.) Install (3) seismagraph stations	X		X		F&M	(15,000)
	e.) Aerial & Photo geotechnical mapping	X	CRREL	X		F&M	(15,000)
	f.) Seismic Refraction and Reflection Surveys	X		X		F&M	(30,000)
	g.) Preliminary Dynamic Analysis	X		X		F&M	(10,000)
10.4	Hydrology and Hydraulics	X		X		WCB	(7,000)
10.5	Tidal Information	X		X	USCGS	WCB	(5,000)
10.6	Water Quality Investigations & Sampling	X		X		WCB	-

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
10.6	a.) Riverine.	X	X	X		WCB	(15,000)
-	b.) Bay Areas	X	X	X		WCB	(25,000)
10.7	Demographic and Economic Activity		-	-		ESAB	-
	a.) Indication of Growth	-	-	-	-	-	-
	1.) Population	X		X		ESAB	(2,000)
	2.) Personal Income	X		X		ESAB	(2,000)
	3.) Per Capita Income	X		X		ESAB	(2,000)
	4.) Employment by Industry	X		X		ESAB	(2,000)
	5.) Production by Industry	X		X		ESAB	(2,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
10.7	b.) Miscellaneous	-	-	-	-	ESAB	-
-	1.) Impacted Industry Studies	X		X		ESAB	(2,500)
	2.) Area Development	X		X		ESAB	(2,500)
	3.) Community Municipal Services	X		X		ESAB	(2,500)
	4.) Availability and Labor Studies Data	X		X		ESAB	(2,500)
10.8	Energy Scenario	X	DOE	-	-	SMT	(10,000)
10.9	Social/Cultural Aspects	X		X		ESAB	(10,000)
10.10	Environmental Aspects	-	-	-	-	-	-
	a.) Biota	X	X	X	X	EAB	-

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
10.10	1.) Fresh Water	X	F&WS	X		EAB	(5,000)
-	2.) Marine	X	NMFS	X		EAB	(5,000)
	3.) Terrestrial	X	F&WS	X		EAB	(5,000)
	b.) Terrestrial Ecosystem	X	F&WS	X		EAB	10,000
	c.) Aquatic Ecosystem	-	-	-	-	-	15,000
	1.) Fresh Water	X	F&WS	X		EAB	(7,000)
	2.) Marine	X	NMFS	X		EAB	(8,000)
	d.) Sampling of Fish Species	X	F&WS	X		EAB	(10,000)
	e.) Preliminary Circulation studies in Bay Area	X		X		WCB	(15,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

		TASK ASSIGNMENTS & RESPONSIBILITIES					
WORK TASK ITEM NO.	WORK TITLE TASK	CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
10.11	Public Health-Hygienic Aspects	X		X		EAB	1,000
10.12	Pollution Contribution	-	-	-	-	EAB	-
	a.) From Land	X		X		EAB	(1,000)
	b.) Industrial	X		X		EAB	(2,000)
	c.) Domestic	X		X		EAB	(2,000)
10.13	Recreation Resources and Facilities	X	NPS HCRS	X	State of Maine	EAB	(10,000)
	(FOR 10.14 - See sheets 10, 11, 12)						

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
10.14	Fish and Wildlife Characterization Studies		EAB USF&WS	X	NMFS	EAB	(120,000)
a.	Terrestrial Ecosystem		USF&WS	X	NMFS	EAB	
b.	Wildlife		U.S. F&WS	X	NMFS	EAB	
c.	Flora		U.S. F.&WS	X	NMFS	EAB	
d.	Marine		U.S. F&WS	X	NMFS	EAB	
e.	Mammals		U.S. F&WS	X	NMFS	EAB	
f.	Waterfowl		U.S. F&WS	X	NMFS	EAB	
g.	Shore and Wading Birds		U.S. F&WS	X	NMFS	EAB	
h.	Pelagic Birds		U.S. F&WS	X	NMFS	EAB	

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
	Fish and Wildlife Studies Continued:	-	-	-	-	-	-
i.	Finfish - Non-anadromous		U.S. F.&WS	X		EAB	
j.	Finfish - Anadromous		U.S. F.&WS	X		EAB	
k.	Invertebrates - Non-Commercial - Benthos		U.S. F.&WS	X		EAB	
-	Invertebrates - Commercial	-	-	-	-	-	-
l.	Shellfish		U.S. F&WS	X		EAB	
m.	Marine Worms		U.S. F&WS	X		EAB	
n.	Lobster		U.S. F&WS	X		EAB	
o.	Macroflora		U.S. F&WS	X		EAB	

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
	Fish and Wildlife Studies Continued:	-	-	-	-	-	-
p.	Plankton		U.S F&WS	X	NMFS	EAB	
q.	Soils		U.S F&WS	X	NMFS	EAB	
r.	Air		U.S F&WS	X	NMFS	EAB	
	Rare and Endangered Species	-	-	-	-	-	-
s.	Bald Eagle		U.S. F&WS	X	NMFS	EAB	
t.	Shortnose Sturgeon		U.S. F&WS	X	NMFS	EAB	
u.	Habitats		U.S. F&WS	X	NMFS	EAB	
v.	Aquatic Ecosystem		U.S. F&WS	X	NMFS	EAB	

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
10.15	Wilderness and Natural Areas	X	U.S. F&WS	X	State of Maine	EAB	(2,000)
10.16	Estuarine, Wetlands and Coastal Zone Areas	X	U.S. F&WS	X	State of Maine	EAB	(5,000)
10.17	Natural Beauty-Scenic Areas	X		X		EAB	(2,000)
10.18	Archeological-Cultural Sites	X		X		EAB	(10,000)
10.19	Historical Sites	X		X		ESAB	(5,000)
10.20	Water bourne transportation routes, types size of vessels and amount of trade	X		X		CDB	(5,000)
10.21	Public Roads in Region	X		X	F.H.A.	ENG. DIV.	(2,000)
10.22	National Marina Fisheries Service (investigations, assessment & analysis)		NMFS	X		EAB	(65,000)
10.23	Mariculture Developments in Region	X	NMFS USF&WS	X		EAB	(10,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					TOTAL COST
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	
10.24	Preparation of Base Maps & Drafting	X		X		ENG. DIV.	(7,000)
10.25	Air Quality in Region	X		X		EAB	(2,000)
10.26	Noise Quality in Region	X		X		EAB	(2,000)
11.0	Public Participation Program	X	-	-	-	SMT	50,000
11.1	Conduct Workshop & Public Meetings	X		X		SMT	(25,000)
11.2	Prepare Brochures & Informational Materials	X		X		SMT	(20,000)
11.3	Response to Public Inquiries	X	-	-	-	SMT	(5,000)
12.0	Accomplish New Studies and Investigations	-	-	-	-	-	370,000
12.1	Hydraulic Turbines, Generating Equip. & Reverse Pumping (an overview)	X		X		WCB	(5,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
12.2	Describe and Evaluate Alternatives to Tidal Power for Generating Electricity	X	-	-	-	-	25,000
-	a. Compressed Air Storage	X		X		SMT	(1,500)
	b. Underground Pumped Storage	X		X		SMT	(1,500)
	c. Conventional Pumped Storage	X		X		SMT	(2,000)
	d. Wind	X		X		SMT	(1,000)
	e. Direct Solar	X		X		SMT	(2,000)
	f. Hydroelectric	X		X		SMT	(3,000)
	g. Nuclear Steam Cycle	X		X		SMT	(2,000)
	h. Conservation and Resource Recovery	X		X		SMT	(2,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
12.2	i. Load-Management	X		X		SMT	(2,000)
	j. Building Insulation Program	X		X		"	(1,000)
	k. Conventional Fossil Thermal Plants	X		X		"	(4,000)
	l. Power Purchases	X		X		"	(1,000)
	m. Geothermal	X		X		"	(2,000)
12.3	New Construction Methods	X		X		ENG. DIV.	(5,000)
12.4	Support Facilities required during Construction, Operation, Maintenance	X		X		ENG. DIV.	(3,000)
12.5	Adequacy for Community Services and REquirements	X		X		ESAB	(2,000)
12.6	Determine Labor and Equipment Requirements for Construction	X		X		ENG. DIV.	(2,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
12.7	Determine Labor and Equipment Requirements during operation and maint. activities	X		X		ENG. DIV.	(2,000)
12.8	Determine Energy Requirements during construction, operation, and maintenance	X		X		ENG. DIV.	(2,000)
12.9	Conceptual Designs for Power Projects	-	-	-	-	-	52,000
	a. Powerhouse	X	North Pacific Div.	X		North Pacific Div. & ENG. DIV.	(15,000)
	b. Navigational Locks	X		X		ENG. DIV.	(4,000)
	c. Earth Rockfill Dams	X		X		ENG. DIV.	(5,000)
	d. Filling-Emptying Gates	X		X		ENG. DIV.	(4,000)
	e. Fishways	X	U. S. F & WS	-		ENG. DIV.	(3,000)
	f. Switchyard	X		X		ENG. DIV.	(5,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
12.9	g. Public Highways (New locations - 2 relocations)	X	F.H.A.	X		ENG. DIV.	(2,000)
-	h. Service Facilities	X		X		ENG. DIV.	(2,000)
	i. Cofferdam	X		X		ENG. DIV.	(4,000)
	j. Closure of Barriers	X		X		ENG. DIV. (Des. Br. WCB)	(10,000)
12.10	New Topography (Photogrammetric mapping and Aerial mosaic for selected areas)	X		X		SMT	(20,000)
12.11	Review of Bathymetry	X	USC&GS	X		"	(1,000)
12.12	Investigation of Experimental Type Generating Facilities to include	-	-	-	-	-	7,000
	a. Alternate Fuels (Wood biomass)	X		X		SMT	(1,000)
	b. Fuel Cells	X		X		"	(500)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES				Monitoring Unit in New England Division	TOTAL COST
		CORPS	AGENCY	CONTR.	OTHER		
12.12	c. Nuclear Fusion	X		X		SMT	(500)
-	d. High Temperature Gas Cooled Reactor	X		X		"	(500)
	e. Fly Wheels	X		X		"	(500)
	f. Super Conducting Magnetic Sotrage	X		X		"	(500)
	g. Batteries	X		X		"	(500)
12.13	Power Values for Capacity and Energy, and likely alternative determination	X	FERC	X		SMT ESAB	(5,000)
12.14	Sources of Local Materials	X		X		F & M	(5,000)
12.15	Construction Cost Estimates	X		X		SMT ENG. DIV	(20,000)
12.16	Annual Operation, Maintenance, and Replacement Costs	X		X		SMT ENG. DIV.	(5,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
12.17	Development of Annual Benefits	-	-	-	-	-	20,000
-	a. Power	X	FERC	X		ESAB	(5,000)
	b. Area Redevelopment	X		X		ESAB	(5,000)
	c. Fisheries - Mariculture	X	U.S.F&WS NMFS	X		EAB	(5,000)
	d. Recreation	X				EAB	(5,000)
12.18	Economic Analysis Studies	-	-	-	-	ESAB	40,000
	a. Benefit-Cost Ratio	X	BPA	X		ESAB	(5,000)
	b. Life Cycle Costing Method	X		X		ESAB	(20,000)
	c. Economic Efficiency Test	X		X		FSAB	(5,000)
	d. Repayment Analysis & Financial Anal.	X	SEPA	X			(10,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
12.19	Generation Mix with Existing System	X	SEPA	X	NEPOOL	WCB SMT	(5,000)
12.20	Social/Cultural Impacts	X		X		ESAB	(10,000)
12.21	Economic Impacts	X		X		" "	(10,000)
12.22	Safety Impacts of Alternatives	X		X		ENG. DIV. Safety Ofc.	(5,000)
12.23	Environmental Impacts	X	U.S.F&WS NMFS	X		EAB WCB	(25,000)
12.24	Engineering Impacts	X		X		ENG. DIV.	(10,000)
12.25	Transportation Impacts	X		X		ESAB	(3,000)
12.26	Magnetic & Seismic Surveys	X		X		F & M	(5,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
12.27	Public Health - Hygienic Impact of Alternatives	X		X		WCB	(2,000)
12.28	Visual Cultural Impacts	X		X		EAB	(2,000)
12.29	Historical Impacts	X		X		ESAB	(2,000)
12.30	Archeological Impacts	X		X		EAB	(5,000)
12.31	Energy Impacts	X		X		WCB SMT	(2,000)
12.32	Real Estate Studies & Impacts (Shoreline, Lands, & Damages)	X		X		Real Estate Div	(15,000)
12.33	Electrical Generation Power Studies (Math model) (For tidal alternatives)	X		X		WCB	(35,000)
12.34	Institutional Arrangements	X	SEPA	X		SMT	(2,000)
12.35	Financial Arrangements	X		X		ESAB	(3,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
12.36	Report on Need for Physical Hydraulic Model	X		X		WCB	(5,000)
12.37	Management Arrangements	X		X		SMT	(3,000)
13.0	Develop Future Projections and Needs	X		X		SMT ESAB	27,000
	a. Population in Area	X		X		ESAB	(1,000)
	(See sheet 26 & 27)						

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COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
13.0	b. Electrical Consumption for:	-	-	-	-	-	-
-	1. Residential Use	X		X		SMT	(1,000)
	2. Industrial Use	X		X		SMT	(1,000)
	3. Municipal/Public Use	X		X		SMT	(1,000)
	c. Types of fuels to be used (exogenous and indigenous)	X		X	State of Maine	SMT	(1,000)
	d. Special Study for Estimated Cost of Fuels & Optimum Project Schedule	X	DOE	X		ESAB	(500)
	e. Construction Costs	X		X		ENG. DIV.	(1,000)
	f. Benefits from Power	X	FERC	X		EAB	(1,000)
	g. Benefits from Fisheries & Mariculture	X	U.S.F&WS NMFS	X		EAB	(1,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
13.0	h. Transmission Requirements		BPA	X		SMT	(1,000)
-	i. Operation and Maintenance Costs	X	BPA	X		ENG. DIV.	(1,000)
	j. General and Relative Inflationary Rates	X	BPA	X		ESAB	(1,000)
	k. Relative Inflationary Rates	X		X		ESAB	(1,000)
	l. Geographic Market Areas	X	SEPA	X		SMT	(1,000)
	m. Environmental Concerns	X	U.S.F&WS NMFS	X	State of Maine	EAB	(3,000)
	n. Social Economic Concerns	X	U.S.F&WS NMFS	X		ESAB	(1,500)
	o. Discount/Interest Rates	X		X		ESAB	(500)
	p. Alternative Futures for Maine & N. E	X		X	State of Maine	ESAB	(4,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
14.0	Establish Criteria & Assumptions	-	-	-	-	-	3,000
14.1	Engineering Aspects	X		X		SMT ENG. DIV.	(1,000)
14.2	Environmental Aspects	X		X		SMT EAB	(1,000)
14.3	Economic	X		X		SMT ESAB	(1,000)
15.0	PLAN FORMULATION FOR TRANSMISSION LINES	-	BPA	-	-	-	30,500
15.1	Preliminary Reconnaissance Study	-	BPA	-	-	SMT	incl.
15.2	Develop System Plans	-	BPA	-	-	SMT	incl.
15.3	Identify Trans. Study Area	-	BPA	-	-	SMT	incl.

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
15.4	Develop Design Alternatives		BPA			SMT	incl.
15.5	Develop Alternative Corridors		BPA			SMT	incl.
15.6	Preliminary Corridor Assessment		BPA			EAB SMT	incl.
15.7	Prepare Stage II Report (For Transmission)		BPA			SMT	incl.

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
16.0	Formulation of Plans for the Tidal Power Project	X		X	State of Maine	SMT	51,000
16.1	Single Pool, Alt. x, with 62.5 MW	X		X		"	(3,000)
16.2	Single Pool, Alt. x, with 125.0 MW	X		X		"	(3,000)
16.3	Single Pool, Alt. x, with 250.0 MW	X		X		"	(3,000)
16.4	Double Pool, Alt. x, with 40.0 MW	X		X		"	(3,000)
16.5	Other Tidal Projects (other concepts not known at this time)	X		X		"	(12,000)
16.6	Pumped Storage	X		X		"	(1,000)
16.7	Compressed Air	X		X		"	(1,000)

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COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
16.8	Development of Unused Low-Head Hydropower in Maine and New England	X		X		SMT	(3,000)
16.9	Out of Area Furchase of Power	X	SEPA	X		"	(2,000)
16.10	Wind Generation	X		X		"	(1,000)
16.11	Direct Solar	X		X		"	(1,000)
16.12	Wood Utilization Thermal Fossil Fuel Fired Plant	X		X		"	(2,000)
16.13	The "Without" or "No Action" Plan	X		X		"	(3,000)
16.14	Environmental Plan for Tidal Power (EQ)	X		X		SMT EAB	(3,000)
16.15	National Economic Development Plan for Tidal Plan (NED)	X		X		SMT ESAB	(3,000)
16.16	Lower Cost Tidal Power Plan for Tidal Power	X		X		SMT	(1,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					TOTAL COST
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	
16.17	Cost Effective Plan for Tidal Power	X		X		SMT	(3,000)
16.18	The Recommended Plan	X		X	State of Maine	SMT	(3,000)
17.0	ACCOMPLISH ELECTRIC POWER MARKETING STUDY		SEPA	X		SMT ESAB	20,000
18.0	Investigate Project Benefits for Alternatives	-	-	-	-	-	10,000
18.1	Power	X		X		EAB	(2,500)
18.2	Area Redevelopment	X		X		ESAB	(2,000)
18.3	Recreation	X		X		EAB	(1,500)
18.4	Fishereies - Mariculture	X		X		EAB	(4,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
19.0	Prepare an Impact and Effects Assessment for Tidal Power Facility	X	BPA	X	EAB	EAB SMT	86,000
19.1	Baseline Information	X	BPA	X	EAB ESAB	SMT	(2,000)
19.2	Future Projections	-	-	-	-	-	4,000
	a. Alternative Futures	X		X		EAB ESAB	(2,000)
	b. Dominent Factors	X		X		ESAB	(2,000)
19.3	Engineering Impacts	-	-	-	-	-	11,000
	a. Project Layout	X		X		WCB DES.BR.	(3,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
	b. Tidal Pools	X		X		WCB DES. BR.	(2,000)
	c. Project Structures	X		X		DES. BR.	(3,000)
	d. Costs	X		X		DES. BR.	(3,000)
19.4	Project Benefits	X		X		ESAB	(3,000)
19.5	Project Economic Analysis	X		X		ESAB	(5,000)
19.6	Financial Arrangements	X		X		"	(2,000)
19.7	Management Arrangements	X		X		"	(2,000)
19.8	Institutional Arrangements	X		X		SMT Div. Coun.	(2,000)
19.9	Marketing Arrangements		SEPA	X		SMT ESAB	(3,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
19.10	Economic Effects (regional and national economic development) (Fisheries Industry, etc.)	X	NMFS U.S.F&WS	X		ESAB	(5,000)
19.11	Social Effects (Social Well-Being)	X		X		ESAB	(2,000)
19.12	Environmental Effects (environmental quality)	X	NMFS U.S.F&WS	X		EAB	(10,000)
19.13	Public Health and Hygienic Impacts	X		X		WCB	(1,000)
19.14	Aesthetic-Visual Impacts	X		X		EAB	(1,000)
19.15	Archeological-Cultural Impacts	X		X		EAB	(1,000)
19.16	Energy Resource-Conservation Impacts	X		X		SMT	(2,000)
19.17	Public Acceptability & Involvement	X		X	Public	SMT	(1,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

		TASK ASSIGNMENTS & RESPONSIBILITIES					
WORK TASK ITEM NO.	WORK TITLE TASK	CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
19.18	Safety	X		X		DES. BR.	(1,000)
19.19	Real Estate	X		X		Real Estate	(10,000)
19.20	Electrical Industry	X	BPA SEPA	X		SMT	(1,000)
19.21	Land Use	X		X		ESAB	(1,000)
19.22	Transportation	X		X		"	(1,000)
19.23	Community Services	X		X		"	(2,000)
19.24	Labor Force	X		X		"	(1,000)
19.25	Geological-Physical Environmental Effects	X		X		F & M	(4,000)
19.26	Tidal Resonance Effects	X		X		WCB	(2,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
19.27	j. Fisn and Wildlife	X	F & W NMFS	X		EAB	(3,000)
19.28	k. Section 404 Evaluation	X		X		EAB	(2,000)
19.29	l. Disposal of Surplus Excavated Materials	X		X		EAB	(1,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
20.0	Prepare Effects & Impact Assessment for Transmission Lines	X	BPA	X		SMT	100,000
20.1	Land Use	X	"	X		"	(16,000)
20.2	Recreation Use	X	"	X		"	(2,000)
20.3	Transportation	X	"	X		"	(2,000)
20.4	Land Ownership	X	"	X		"	(10,000)
20.5	Hydrologic Features	X	"	X		"	(5,000)
20.6	Cultural Resources	X	"	X		"	(5,000)
20.7	Unique Natural Resources	X	"	X		"	(5,000)
20.8	Physiography/Topography	X	"	X		"	(20,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE ASK	TASK ASSIGNMENTS & RESPONSIBILITIES CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
20.9	Wildlife	X	BPA	X		SMT	(10,000)
20.10	Fish	X	"	X		"	(5,000)
20.11	Vegetation	X	"	X		"	(10,000)
20.12	Existing Utility Row	X	"	X		"	(10,000)
21.0	Project Evaluation	X	(All)	X		SMT EAB ESAB	15,000

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
22.0	Preparation of Stage II Report (Devel. Inter. Plans)	X	All	X		SMT	48,000
22.1	Environmental Portions	X		X		EAB	(10,000)
22.2	Cultural/Social/Economic portions	X		X		ESAB	(10,000)
22.3	Power Portions	X		X		WCB	(10,000)
22.4	Stuructural portions	X		X		DES. BR.	(5,000)
22.5	Geologic/Foundation Portions	X		X		F & M	(8,000)
22.6	Coordination	X	All		State of Maine	SMT	(5,000)
23.0	Study Management	X				SMT	90,000
24.0	Supervision and Administration	X				NED	90,000

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
	STAGE III - DEVELOPMENT OF FINAL PLANS						
25.0	Public Participation Program	X		X		SMT	50,000
25.1	Conduct Workshops & Meetings	X		X		PAO SMT	(25,000)
25.2	Prepare Brochures & Informational Material	X		X		PAO SMT	(20,000)
25.3	Response to Public Inquiries	X				PAO SMT	(5,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
26.0	Formulate and Develop Final Power Project Plans	X	All	X		SMT	275,000
26.1	Circulation Studies Engineering Aspects	X		X		Eng. Div.	(95,000)
26.2	Economic Aspects (including, easmts, row)	X	ESAB Real Estate	X		ESAB	(20,000)
26.3	Environmental Aspects	X	U.S. Fish& WS - NMFS	X		EAB	(60,000)
26.4	Aesthetic-Visual Aspects	X		X		EAB	(10,000)
26.5 26.6	Financial Arrangements Acceptability Aspects	X		X		ESAB SMT	(5,000) (5,000)
26.7 26.8	Institutional Arrangements Finalize Project Benefits	X		X		ESAB SMT	
	a. Power	X		X		ESAB	(3,000)
	b. Area Redevelopment	X		X		ESAB	(3,000)

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COBSCOOK BAY, MAINE TIDAL POWER PROJECT

PLAN OF STUDY

DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
	c. Fisheries-Mariculture	X	NMFS U.S.F&WS	X		ESAB	(2,000)
-	d. Recreation	X		X		ESAB	(2,000)
26.9	Project Economic Analysis	-	-	-		-	-
	a. Benefit-Cost Ratio	X	BPA	X		ESAB	(1,000)
	b. Life Cycle Costing	X	FERC	X		ESAB	(1,000)
	c. Repayment Analysis	X	FERC SEPA	X		ESAB	(1,000)
	d. Financial Feasibility	X	FERC SEPA	X		ESAB	(1,000)
	e. Electrical Marketing	X	SEPA	X		ESAB SMT	(1,000)
26.10	Identifying Problems and Needs	X	DOE		State of Maine & Public	SMT	(5,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES: CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
26.11	Validation of Seismic Studies	X		X		F & M	(15,000)
26.12	Power Project Designs and Costs	X		X		Eng. Div. SMT	(40,000)
27.0	Formulate and Develop Final Plans For Transmission Facilities	-	-	-	-	-	250,000
27.1	Determine Corridor Evaluations	-	BPA	X	-	SMT	(75,000)
27.2	Develop Corridor Preference	-	BPA	X	-	SMT	(75,000)
27.3	Prepare Transmission Report	-	BPA	X		SMT	(50,000)
27.4	Prepare EIS on Transmission Facilities (Including Section 404 Evaluation and Statement of Findings)		BPA	X		SMT	50,000

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
27.4	a. Socio-economic		BPA	X		SMT	incl.
	b. Natural Systems		BPA	X		SMT	incl.
	c. Cultural		BPA	X		SMT	incl.
	d. Visual		BPA	X		SMT	incl.
	e. Engineering		BPA	X		SMT	incl.
	f. Prepare Transmission Portion of Combined EIS		BPA	X		SMT	incl.

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
28.0	Prepare Draft Stage III Report on Project	X	All	X		SMT	54,000
28.1	Environmental Aspects	X		X		EAB	(9,000)
28.2	Cultural/Social/Economic Aspects	X		X		ESAB	(10,000)
28.3	Power Generation Aspects	X		X		WCB	(10,000)
28.4	Structural Components	X		X		DES. BR.	(10,000)
28.5	Geologic/Foundation Considerations	X		X		F & M	(10,000)
28.6	Coordination	X		X		EAB SMT	(5,000)
29.0	Prepare Draft Environmental Impact Statement (Including 404 and Statement of Findings	X		X		EAB SMT	208,000
29.1	Biota					EAB	(7,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
29.2	Terrestrial Ecosytem	X		X		EAB	(3,000)
29.3	Aquatic Ecosystem	X		X		EAB	(4,000)
29.4	Results of Sampling of Fish Species	X	F & WS	X		EAB	(25,000)
29.5	Discussion of Circulation Studies in Bay	X		X		WCB	(10,000)
29.6	Public Health-Hygienic Aspects	X		X		EAB	(1,000)
29.7	Pollution Contributions	X		X		EAB	(3,000)
29.8	Recreation Resources & Facilities	X		X		EAB	(7,000)
29.9	Fish & Wildlife Characteristics	X	F & WS	X		EAB	(80,000)
29.10	Wilderness & Natural Areas	X		X		EAB	(1,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
29.11	Estuarine & Wetland Areas & Coastal Zone	X		X		EAB	(5,000)
29.12	Scenic Areas	X		X		EAB	(1,000)
29.13	Archeological & Historical Sites	X		X		EAB	(2,000)
29.14	Institutional Aspects and Energy	X		X		ESAB	(2,000)
29.15	Assessment from Nat'l Marine Fisheries Service		NMFS	X		EAB	(45,000)
29.16	Mariculture	X		X		EAB	(5,000)
29.17	Air Quality	X		X		EAB	(1,000)
29.18	Noise Quality	X		X		EAB	(1,000)
29.19	Technical Aspects (Structures, Transmission & Seismic)	X		X		EAB F&M	(5,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

		TASK ASSIGNMENTS & RESPONSIBILITIES					
WORK TASK ITEM NO.	WORK TITLE TASK	CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
30.0	Prepare Final Stage III Report on Project	X	All	X		EAB	56,000
30.1	Environmental Aspects	X		X		EAB	(8,000)
30.2	Cultural/Social/Economic Aspects	X		X		ESAB	
30.3	Power Generation Aspects	X	FERC	X		WCB	(10,000)
30.4	Structural Components	X		X		DES. BR.	(10,000)
30.5	Geologic/Foundation Considerations	X		X		F&M	(10,000)
30.6	Coordination	X		X		SMT	(8,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
31.0	Prepare Final Environmental Impact Statement for Project	X		X		EAB Div Coun.	56,000
31.1	Biota	X		X		EAB	(3,000)
31.2	Terrestrial Ecosystem	X		X		"	(3,000)
31.3	Aquatic Ecosystem	X		X		"	(3,000)
31.4	Results of Sampling of Fish Species	X	NMFS F & WS	X			(2,000)
31.5	Results of Circulation Study in Bay	X		X		WCB	(8,000)
31.6	Public Health - Hygienic Aspects	X		X		EAB	(1,000)
31.7	Pollution Contributions	X		X		"	(1,000)
31.8	Recreation Resource & Facilities	X		X		"	(2,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
31.9	Fish & Wildlife Characteristics	X	F & WS	X		EAB	(10,000)
31.10	Wilderness & Natural Areas	X		X		"	(1,000)
31.11	Estuarine, Wetland and Coastal Zone Areas	X	F & WS	X		"	(2,000)
31.12	Scenic Areas	X				"	(1,000)
31.13	Archeological and Historical Sites	X		X		"	(1,000)
31.14	Institutional Aspects and Energy	X		X		"	(1,000)
31.15	Assessment from Nat'l Marine Fisheries Service		NMFS	X		"	(9,000)
31.16	Mariculture	X	F & WS NMFS	X		"	(3,000)
31.17	Air Quality	X		X		"	(1,000)

COBSCOOK BAY, MAINE TIDAL POWER PROJECT

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DETAILED WORK TASK & ASSIGNMENTS

WORK TASK ITEM NO.	WORK TITLE TASK	TASK ASSIGNMENTS & RESPONSIBILITIES					
		CORPS	AGENCY	CONTR.	OTHER	Monitoring Unit in New England Division	TOTAL COST
31.18	Noise Quality	X	-	X	-	EAB	(1,000)
31.19	Technical Aspects (Structures, Transmission & Seismic)	X		X		EAB F&M	(3,000)
32.0	Study Management	X	-	-	-	SMT	90,000
33.0	Supervision and Administration	X	-	-	-	SMT	90,000

PAO	Public Affairs Office (NED)	BPA	Bonneville Power Administration
SMT	Study Management Team	SEPA	Southeastern Power Administration
F&W	U.S. Fish and Wildlife Service	DOE	Department of Energy
EAB	Environmental Analysis Branch	CDB	Coastal Development Branch
ENG DIV	Engineering Division		
F&M	Foundation & Materials Branch		
ESAB	Economic & Social Analysis Branch		
WCB	Water Control Branch		
CONSTR DIV	Construction Division		
DES BR	Design Branch		
OPS DIV	Operations Division		
REAL ESTATE DIV	Real Estate Division		
SUR BR	Survey Branch		
NMFS	National Marine Fisheries		
HCRS	Heritage, Conservation and Recreation Service (formerly BOR)		
NED	New England Division		
WES	Waterways Experimental System		
CRREL	Cold Regionals Research & Engineering Laboratory		
NPS	National Park Service		
USC&GS	U.S. Coast & Geodetic Survey		

SECTION V

PUBLIC INVOLVEMENT AND COORDINATION

SECTION V

PUBLIC INVOLVEMENT
AND
COORDINATION

SECTION V

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V. PUBLIC INVOLVEMENT AND COORDINATION

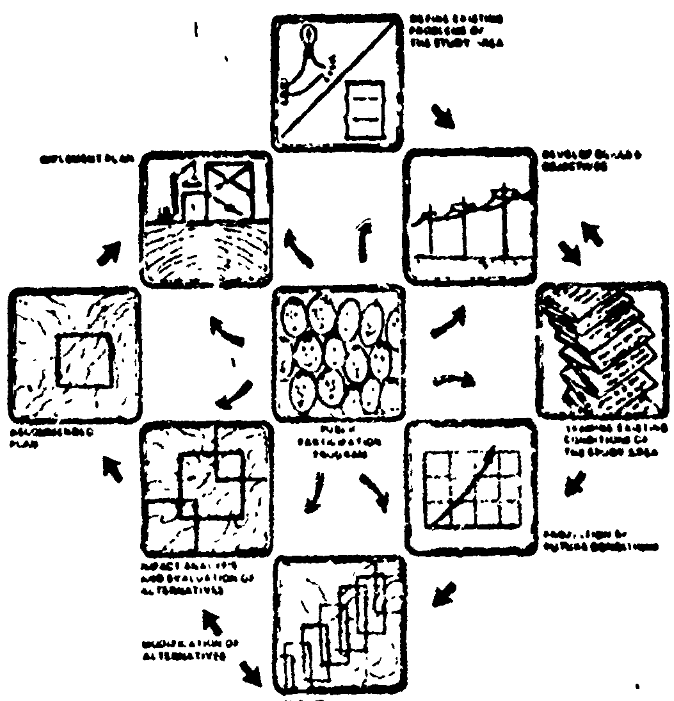
A. General.

This section describes the proposed Public Participation Program often referred to as an Open Planning Process for the tidal power study. During the various stages of the study, the views, interaction, dialogue, reviews and reactions from the public are desired to assure proper planning and to arrive at a feasible and acceptable plan. In addition, the program will be utilized to inform the public about the project.

For the purpose of this study, the "public" is defined as any private individual, elected official, organization agency, etc. other than the Corps of Engineers.

In all phases of the study the planning process will allow interaction by the Public Involvement Program. As Figure V-1 indicates, the public should be at the center of the planning process. The public should be involved in working with the planners by providing their input throughout the life of the project, which initiates with identifying the problems and continues through implementation and construction of a project.

Refer to Attachment No. 1 for Public Participation Program for the Tidal Power Study.



Interaction of the Public Participation Program

Figure V-1

B. THE PUBLIC INVOLVEMENT PROGRAM - AN OVERVIEW

1. Reasons for Public Involvement.

Coordination with the public in regards to planning of projects and their associated environmental impacts is required by legislative and executive authority.

It is also considered necessary that assistance, participation, and input from the public be received while the Plan of Study is being prepared.

The general format for the POS document itself is based on Corps of Engineers guidelines and procedures for planning Water Resource Projects as contained in Corps of Engineers, Engineering Regulations ER 1105-2-200 series. The regulation requires that a Section be devoted to the planning of a public participation program which will be continuous throughout the study period. Throughout the study, the public will be encouraged to actively assist in the formulation and selection of alternative plans.

2. Purposes of the Program.

- Promote public understanding of the Corps planning process, especially for the tidal project and transmission facilities at hand;
- Keep the public informed about the status, findings and implications of the study;
- Solicit public input regarding the needs, problems, preferences for solutions, objections and suggestions regarding the overall tidal power project, including the transmission lines.

3. Design of the Public Involvement Program.

The public involvement program will be designed around the following steps:

- Determine the public involvement objectives for each stage of the survey investigation
- Identify the publics
- Select the public to be contacted
- Selection of Public Involvement Mechanism
- Commence early implementation
- Recognition of constraints
- Monitor and Evaluate the program

4. Public Involvement Mechanisms.

There are three basic mechanisms for public involvement. They are public meetings, workshops/seminars/citizens coordinating panels, and printed materials.

a. Public Meetings - During the course of this tidal power study, there will be at least three sets of public meetings where the public can officially participate and express their views concerning any alternative. These meetings (early, mid-stage and late stage) will be held in the study area and in any other areas that may be designated. In conducting these meetings, progress made by the study team will be presented in a concise and informative manner. At the conclusion of the presentations, the meeting will be opened to public discussion and the study team will answer any questions that the public might have. It is intended to encourage attendance of the public and officials at these meetings. It is desired that these meetings will be a two-way street; the study team will inform the public, and the public will inform the study team of their views on the tidal power project.

In addition to the public meetings, the study team will assist any interested organization in conducting informal meetings on the project.

b. Workshops, Seminars, and Citizen Coordinating Panels - In developing citizen involvement, it is foreseen that a series of informal informational meetings, workshops and seminars would be useful in identifying concerns, problems, and constraints. These workshops and meetings (ideally) would be small and conducted in many locations. Hopefully, such meetings would develop into discussion sessions where citizens ask questions, comment and discuss points of interest or concern. In addition, there might be seminars or public appearances where members of the study team would go to citizen groups to give presentations on the progress of the study. As the project develops, it will be advantageous that a Citizens Coordinating Panel (CCP) be established. This panel would assist in disseminating information on the study, render opinions and views on study material to the Study Team, and act as a public pulse for the study in general. It is desired that the CCP comprise 6-8 persons representing a good cross section of public interests.

c. Printed Materials - In order to inform the public, it will be necessary to disseminate informational material. A brochure which explains the study objectives as seen by the study team will be prepared. Periodically, news letters or technical fact sheets will be prepared to explain the progress of the study. News letters will be sent to all public officials and interested citizens whose names come to the attention of the study team. The public information program will also be coordinated with the news media to increase dissemination of project data.

5. Program Flexibility.

It is intended to execute a dynamic public involvement program for the study. As the study period will be about 4 years in length, the program may require adjustment at various intervals to relflect changing needs, public objectives, environments, or alterations in the overall study program.

C. PUBLIC INVOLVEMENT DURING THE PREPARATION OF THE PLAN OF STUDY - (AS PLANNED)

As previously mentioned, during the preparation of the Plan of Study, it is desired to obtain input and views from the public on the project itself, the planning process, items to be studied, priorities, and public participation during the course of the overall study. In order to accomplish this, the following steps were/are being taken by the Study Management Team:

- To defer to the Honorable James B. Longley, Governor of Maine, to issue a public announcement stating that the Corps plans to accomplish a 4-year study of the tidal power project.

  (Note: This was accomplished on 7 October 1977)

- Initiate the preparation of a preliminary Plan of Study which will serve as a document which the public can react to, suggest modifications, etc.

- Issuance of a Corps Notice advising the public that Public Meetings will be held in the State of Maine, for the purpose of informing the public of the study and requesting their input to the preliminary Plan of Study document.

- Conduct Corps sponsored Public Meetings in Maine which will inform and present the tidal power study to the public.

- Conduct workshops in Maine and elsewhere as necessary wherein representatives of the state, academia and others can discuss the overall study and the Plan of Study.

- Prepare and distribute a newsletter which presents particulars of the project and the results of the preparation and public reviews of the Plan of Study.
- Distribute copies of the Plan of Study to interested agencies and participants in the study.
- Form a Citizens Advisory Panel which will provide input to the study, reflect public impressions, etc.

D. SUMMARY OF PUBLIC INVOLVEMENT DURING PREPARATION OF THE PLAN OF STUDY

Since the time that authority to re-evaluate the Passamaquoddy Tidal Power Project was received in December 1975 and during the preparation of a preliminary economic feasibility study to determine if further tidal power study was warranted the New England Division carried out a limited type of public participation program; the program was more of an informational type which informed some of the publics that the study had been authorized and furnished a description of the project as well as advising them what items were to be studies in the future. Following is a summary of dates and audiences which staff members of the New England Division made presentations to:

DATE	LOCATION	TYPE OF AUDIENCE	ESTIMATED ATTENDED
21 Jan 1976	Cambridge, MA	Mass. Institute of Technology Student Group	50
16 Mar 1976	Boston, MA	Federal Energy Task Force in New England	15
8 Feb 1977	Newton, MA	Institute for Electrical and Electronic Engineers	40
14 Apr 1977	Medford, MA	Tufts University Engineering Student Group	30
17 Oct 1977	Augusta, ME	Governor James B. Longley made public Announcement that the Corps would conduct further study on the tidal power project	--

DATE	LOCATION	TYPE OF AUDIENCE	ESTIMATED ATTENDED
27 Oct 1977	Augusta, ME	State Officials in State House, Maine	20
2 Dec 1977	Medford, MA	Environmental Action Group, Tufts University	25
4 Feb 1978	Waltham, MA	Corps of Engineers Officers of New England	30

In addition, copies of the preliminary economic feasibility report were distributed in 19 October 1977 to the State of Maine Congressional Delegation, State of Maine officials, interested Federal Agencies, and Officials in the City of Eastport, Maine.

The Public Meetings held in Maine in July 1978 informed the public of the proposed study and advised them of the planning process and what items were being considered to be studied. The handout information and the project presentation furnished information for the public to react to, and for supplying feedback to the Study Management Team. The public was asked for input and to express their views of the planning process, identify and comment on power and other water resource needs in the region, study items and their importance, project scheduling, costs, what kind and depth of a public involvement program they desire, etc.

In February 1978 it was considered that the University of Maine, College of Arts and Sciences Department, would be an excellent resource for assisting the study management team in formulating a Public Participation Program for the tidal power project. On 8 March 1978 representatives of the New England Division met in Orono, Maine with Dean Haaland and Professor Johnson to discuss in a preliminary fashion what such a program might entail especially during the Plan of Study period. Preliminary results of the meeting indicated that the preparation and dissemination of informational data on the project should be accomplished, that five workshops on specific subjects (i.e. energy, environment) should be held, and that two public meetings on the study should be conducted. It was also agreed and considered essential that the first workshop would be held in Eastport, Maine in the vicinity of the project site, and that active and joint participation by the State of Maine agencies be engaged.

On 20 March 1978 a joint meeting was held in Augusta, Maine with representatives of the University of Maine, various State of Maine Agency officials and the Corps of Engineers. University of Maine personnel presented, and those in attendance concurred with, the proposed public involvement activities for the Plan of Study period. The Director,

Office of State Planning, made specific note of Governor James B. Longley's interest in the tidal power study and desire for active participation in the study by State agencies.

As a result of these meetings the New England Division, through the University of Maine (Orono), conducted five workshops at the locations listed below, during the preparation of the Plan of Study, to obtain public views and inputs.

Location	Subject	Date	Attendance
Eastport, Maine	Local Concerns	31 May 1978	15
Orono, Maine	Natural Resources and Environmental Considerations	5 June 1978	25
Augusta, Maine	Energy Alternatives	7 June 1978	20
Portland, Maine	Social-Cultural Considerations	9 June 1978	15
Boston, Mass.	Economic Considerations	12 June 1978	15

The personnel attending the workshops mostly possessed qualifications in the subject of the workshop they attended. The outcome of the workshops permitted the Division to make a more meaningful Plan of Study with less gaps and omissions in items to be studied.

After completion of the workshops, three Public Meetings, as listed below, were conducted by the Division Engineer. In order to provide background information at these meetings, a fully automated audio visual presentation concerning the project was used.

Location	Date	Attendance
Eastport, Maine	10 July 1978	175
Augusta, Maine	13 July 1978	75
Lubec, Maine	27 July 1978	50

E. FUTURE PUBLIC INVOLVEMENT ACTIVITIES DURING STAGES II AND III

During Stages II and III (Development of Intermediate and Final Plans) which will be approximately twenty months each, a continuous open planning program will be conducted. Public meetings, workshops, informational meetings, newsletters, etc. will be conducted and/or distributed. For more detailed information see Attachment 1.

The public involvement during these stages will involve formulation of technical or systems alternatives for the tidal power project and transmission lines, assessment and evaluation of impacts and the overall Environmental Impact Statement.

The open planning for both the transmission facilities and the tidal power project shall be carried out and presented jointly at public meetings and during other public involvement activities.

F. MISCELLANEOUS PUBLIC INVOLVEMENT ACTIVITIES

1. Processing of Information

The Study Management Team will prepare information newsletters, brochures and various reports on the project for public distribution as well as respond to letters, questions, and other written comments received from the public. Other means for disseminating project information and receiving comments will be through:

- Public Meetings (early, mid-stage, late-stage)
- Workshops and Seminars
- Informational Meetings
- Presentations to groups (10 or more) upon request

Information will also be distributed through coordination with radio, television and other forms of media.

A mailing list will be maintained by the Corps of Engineers for distributing data to involved agencies, and interested groups and individuals.

2. Coordination with Agencies

Coordination of the study with other agencies will be carried out during the study period. Further information on these coordination activities are contained in Attachment 3 and 4. this Plan of Study.

3. Record of Public Involvement

A record of the public involvement program will be made and presented in a sub-appendix to the project report (tidal power and transmission lines), and a separate "Comments and Response" section will be prepared for the associated Environmental Impact Statement.

4. Availability of Printed Materials

Copies of most printed materials will be available for distribution by requests. All printed materials including newly produced reports, transcripts of Public Meetings and notes from Workshops will be available for inspection of at various libraries throughout New England (See Attachment 2 for a list of libraries).

SECTION V

ATTACHMENTS

ATTACHMENT NO. 1 (SECTION V)

FUTURE PUBLIC PARTICIPATION PROGRAM

FOR

TIDAL POWER STUDY

I. Introduction

The goals of this public involvement program are to inform all interested publics to involve in a meaningful way appropriate public expertise, to identify the important issues within the available time frame and to encourage and help develop appropriate participation from federal and state agencies and appropriate private and corporate citizens.

The primary strategy will be to hold a series of workshops in preparation for public meetings focused on the development of the tidal power plans and alternatives and associated assessment and evaluation.

II. Workshops

A. General

The Study Team proposes to organize workshops over the term of the planning process for the Cobscook Bay Hydroelectric Project. These workshops would periodically bring together members of the U. S. Army Corps of Engineers and members of the informed public for discussions of the current status of the project. We anticipate using the workshop format in lieu of a steering or advisory committee.

These workshops would consist of crucial opinion leaders of the local community, state and region, as well as appropriate persons from the state and federal agencies with an interest in the Tidal Power Project. These workshops would:

1. Bring all persons up-to-date on the plan development

2. Provide informed comment on the plan at each of several stages

3. Provide a working group atmosphere for the development and identification of alternatives

The major advantage of this procedure would be the development of a cadre of several hundred involved, knowledgeable, and interested advisors.

There would be standing invitations to certain people and offices, while the remainder would be new participants. Two sets of such workshops a year, varying in location, would provide an overall involvement of 60-80 persons per year.

B. Preliminary Preparation

Preliminary preparation includes:

1. research necessary for the preparation of written materials

2. the preparation of the information material to be presented to participants in the workshops including:

   (1) general fact sheet
   (2) materials specific to each workshop

3. the identification of major topics to be discussed for all workshops and for each workshop

C. Format

The format used will be a working group concept with the Study Team providing the following:

1. a moderator and recorder for each session

2. formulation of specific questions for discussion and the utilization of a process which will identify crucial issues

3. insuring adequate discussion of each question and issue

D. Location

The Study Team will identify and arrange for appropriate locations.

E. Participants

The Study Team would identify and invite appropriate participants for each workshop. These persons would have some competence or expertise in the general subject matter of the workshop to which they are invited. The public will be also invited for general comment and response.

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III. Post Workshop

A. The Study Team will write a summary of each of the workshops including:

1. Identification of problems identified by workshop participants

2. Identification of positions on issues by workshop participants

3. Identification of benefits of the project

4. Identification of alternatives available.

B. The Study Team will write an overall summary of the workshops in preparation for the public meetings.

C. The Study Team will translate the results into an appropriate exercise which will provide an opportunity at the public meetings to set the issues in order of priority as seen by those persons present at the public meeting.

IV. Public Meetings

A. General

Public Meetings will be conducted during the mid and late stages of the study. The purposes of these meetings is to provide an opportunity for the study results to be presented to the public and to obtain their feedback and views. The meetings will be conducted in larger facilities so as to permit greater attendance. At least one public meeting during each of the mid and final states of the study will be held in the study area.

B. The Study Team will:

1. Identify the appropriate place and time.

2. Identify participants

3. Prepare appropriate bacground information for the public hearings which will be available to thosewho come or to other interested persons

4. Identify the major topics to be discussed at the public meetings

5. Record the Public Meeting (both verbal and written statements)

IV. Post Public Meetings

The Study Team will distribute copies of the record of the meetings to designated libraries and depositories as indicated in Attachment No. 3.

The results of the public meetings will be utilized in the planning of the project.

V. Informational Bulletins and Newsletters

The Study Team will issue and distribute informational data on the project as the study progresses. This data will be published as bulletins, newsletters and handouts for workshops and public meetings.

VI. Mailing List

Mailing lists of interested individuals, firms, agencies, etc. will be maintained for the purpose of distributing written information on the project.

VII. Coordination with News Media

The Corps of Engineers Public Affairs Office will advise and furnish the news media information of the project as it develops as well as timing of scheduled events such as workshops and public meetings.

VIII. The Program in General

The Public Involvement Program will be basically designed around the following seven steps:

- Determine the public involvement objectives for each stage of the study
- Identify the publics
- Select the public involvement mechanisms
- Commence early implementation
- Recognize constraints
- Monitor and evaluate the program

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LIST OF LIBRARIES AND DEPOSITORIES FOR TIDAL POWER PROJECT INFORMATION

ATTACHMENT NO. 2 (SECTION V)

CONNECTICUT

Hartford	State Library
Storrs	University of Connecticut

MAINE

Augusta	Natural Resources Council
	State House Law & Legislative Library
Auburn	Androscoggin Regional Planning Comm.
Bangor	Public Library
	U.S. Department of Energy
	Penobscot Valley Regional Planning Comm.
Biddeford	McArthur Public Library
Brunswick	Longfellow Library (Bowdoin College)
Calais	Town Hall, Public Library
Castine	Nutting Memorial Library (Maine (Maritime Academy)
Dennysville	Robert S. Friedman Laboratory (Suffolk University)
Eastport	Town Hall, Public Library
Farmington	University of Maine
Lewiston	Bates College
Lubec	Town Hall, Public Library
Machias	University of Maine
	Washington County Regional Planning Comm.
Orono	University of Maine
Portland	Public Library Center for Research and Advanced Study
	University of Maine Law Library and Documents Department
Presque Isle	University of Maine
Springvale	Anderson Learning Library (Nasson College)
Unity	College Library
Waterville	Public Library, Miller Library (Colby College)
Winslow	North Kennebec Regional Planning Comm.

Attachment 2 - (cont'd) (Section V)

MASSACHUSETTS

Amherst	University of Massachusetts
Boston	Public Library
	U.S. Department of Energy Regional Office
	Fingold State Library
Cambridge	Harvard Graduate School of Design Widner Library
	Massachusetts Institute of Technology
Chestnut Hill	Babst Library (Boston College)
Lowell	Alumni Memorial Library (University of Lowell)
Waltham	U.S. Army Corps of Engineers
	Goldfarb Library (Brandeis University)
Worcester	Gordon Library (Worcester Polytechnical Institute)

NEW HAMPSHIRE

Concord	State Library
Durham	Dimond Library (University of New Hampshire)
Franconia	North Country Council
Groveton	Public Library
Hanover	Baker Library (Dartmouth College)
Hudson	Hills Memorial Library
Manchester	City Library

RHODE ISLAND

Kingston	University of Rhode Island
Providence	State Library
	Brown University

VERMONT

Burlington	Bailey Memorial Library (University of Vermont)
Essex Junction	Chuttenden County Regional Planning Comm.

VERMONT - (cont'd)

Montpelier	Central Vermont Regional Planning Comm.
	State Library
	The Free Library
St. Johnsbury	Northeast Development Association
	St. Johnsbury Athenaem

ATTACHMENT 3 (SECTION V)

LIST OF AGENCIES FOR STUDY COORDINATION

Coordination of the Tidal Power Study will be carried out with the following agencies:

FEDERAL

Environmental Protection Agency

Council on Environmental Quality

Advisory Council on Historic Preservation

Department of Transportation

. Federal Highway Administration

Department of Commerce

. Coast Guard

. National Oceanic and Atmosphere Administration

. Coastal Zone Management

. National Marine Fisheries Service

Department of Health, Education and Welfare

. Office of Environmental Affairs

Department of Agriculture

. Social Conservation Service

. Forest Service

Department of Interior

. Office of the Secretary

. Geological Survey

. Coast and Geodetic Survey

Attachment 3- (cont'd) (Section V)

Department of Interior - (cont'd)

- Fish and Wildlife Service
- Bureau of Outdoor Recreation
- National Park Service
- Bureau of Reclamation

Department of Energy

- Department of Energy, Region I
- Bonneville Power Administration
- Geothermal Energy (Washington, D.C.)
- Southeastern Power Administration
- Federal Power Regulatory Commission

Department of Housing and Urban Development

Federal Insurance Administration

Department of Labor

- U.S. Fish and Wildlife Services (Ecol. Services)
- U.S. National Marine Fisheries Service
- Federal Energy Regulation Commission
- Bonneville Power Administration
- Southeastern Power Administration

STATE OF MAINE

Office of the Governor

Office of Energy Resources

Department of Environmental Protection

Attachment 3 - (cont'd) (Section V)

STATE OF MAINE - (cont'd)

Bureau of Public Land

Department of Marine Resources

Department of Inland Fisheries & Wildlife

State Planning Office

State Geologist

Coastal Zone Management

REGIONAL

New England Regional Commission

New England Council

New England River Basins Commission

New England Governors Council

New England Interstate Water Pollution Control Commission

OTHER

Washington County Regional Planning Commission, Maine

Passamaquoddy - Pleasant Point Tribal Council

The Cities of Eastport, Lubec, and the other communities surrounding Cobscook Bay

ATTACHMENT 4 (SECTION V)

STATUTORY AND REGULATORY COORDINATION

Interagency coordination is required by the U.S. Federal Law in Water resources planning studies with Federal, State and Local agencies. Corps of Engineers' Engineering Manual EM 1120-2-101 discusses interagency coordinators in great depth. Following is a listing of the major laws which require coordination in the planning and design stages of such projects:

TABLE - STATUTORY AND REGULATORY COORDINATION

LAW	COORDINATE WITH WHOM
Flood Control Act of 1917 (1 March 1917)	Federal Agencies
Flood Control Act of 1938 (28 June 1938)	Institutions Organizations Individuals
Flood Control Act of 1944 (22 December 1944)	Affected State Department of the Interior
Fish & Wildlife Coordination Act (12 August 1958)	Fish & Wildlife Service, Dept. of the Interior State agency exercising administration over wildlife in area of investigation
River & Harbor Act of 1960 (14 July 1960)	State Agencies
Forest Conservation Act (6 September 1960)	Secretary of Agriculture Appropriate State conservation agency
Federal Water Pollution Control Act Amendments of 1961 (20 July 1961)	Secretary of the Interior

Attachment 4 - (cont'd) (Section V)

LAW	COORDINATE WITH WHOM
Outdoor Recreation Act (28 May 1963)	Heritage, Conservation and Recreation Service
Federal Water Project Recreation Act (9 July 1965)	Nonfederal public bodies
Water Resources Planning Act (22 July 1965)	Federal agencies, States, local governments, Individuals, Corporations, Businesses, Others concerned and River basin commissions
Wild and Scnic Rivers Act (2 October 1968)	Secretary of the Interior Secretary of Agriculture
Memorandum of Agreement with Corps of Engineers and Bureau of Reclamation (10 December 1970)	Bureau of Reclamation
Intergovernmental Cooperation Act of 1968 (16 October 1968)	State and Local Governments
National Environmental Policy Act of 1970 (1 January 1970)	Federal agencies, State agencies and Local agencies
Federal Water Pollution Act Amendments of 1972 (18 October 1972)	Environmental Protection Agency
Coastal Zone Management Act of 1972 (27 October 1972)	States
Conservation Protection, and Propogation of Endangered Species Act (28 December 1973)	Secretary of the Interior
Water Resources Development Act of 1974 (7 March 1974)	States
Preservation of Historical and Archeological Data Act (24 May 1974)	Secretary of the Interior

Canadian Embassy   Ambassade du Canada

1746 Massachusetts Ave. N.W.
WASHINGTON, D.C.20036

10 May 1978

Dear Karl,   re: Passamaquoddy Tidal Project

I refer to your letter of December 13, 1977 inviting Canada to participate in or to observe the U.S. study on the Passamaquoddy Tidal Project. I have now been asked to inform you that Canada does not plan to participate in such a study but we would be interested in accepting your offer of naming an observer. Dr. R.G. Skinner, Environment Advisor, Science and Technology, Dept of Energy Mines and Resources will be the designated observer. His mailing address is 580 Booth Street, Ottawa K1A 0E4.

I would like to express to you and to the Corps of Engineers our appreciation for having extended this invitation to Canada.

Yours sincerely,

George

George Rejhon
Counsellor (Environment)

Mr. Karl Jonietz
Environmental Officer
Office of Canadian Affairs
Room 5227 Dept. of State
WASHINGTON, D.C. 20520

ATTACHMENT NO. 5 (Section [illegible])

Public Information Brochure

PREPARED FOR

PUBLIC MEETINGS

FOR THE

TIDAL POWER STUDY

COBSCOOK BAY, MAINE, USA

ON MONDAY EVENING JULY 10, 1978 AT 7:00 PM at Eastport Municipal Auditorium (Shead Memorial High School) Eastport, Maine	AND THURSDAY AFTERNOON JULY 13, 1978 at 1:30 PM at Civic Center Augusta, Maine

U.S. ARMY CORPS OF ENGINEERS
New England Division
424 Trapelo Road
Waltham, Massachusetts 02154